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METASTATIC CARCINOMA OF THE EYEBALL.

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CASE I.—Mrs. J. J., æt. 57, was seen early in 1895, and was found to be suffering from a tumour of the right breast. It had all the appearances of being a scirrhus. On May 7, 1895, the breast together with the axillary glands were removed, and the diagnosis of scirrhus was confirmed by pathological examination.

The wound healed slowly, but was quite closed by June 28.

The patient remained in good health for about 17 months, when she found the sight of her right eye failing.

She was then seen by Mr. John Couper, who diagnosed an intraocular tumour. In December, 1896, the eye was removed, and was sent to me for pathological examination. Very shortly after this, patient developed ascitis, there was some pain and swelling of the right arm, and some pain also in the left arm, but no tumour could be felt, and there was no sign of local recurrence.

In March, 1897, death took place, and although no post-mortem examination was made, yet there was every indication that the patient had secondary deposits in the abdomen which proved fatal.

The eye after removal was hardened in alcohol, and the following is the description of it.

The cornea has been rendered opaque by the hardening fluid, but appears to be otherwise healthy. The anterior chamber is shallow, and the angle narrowed but not closed.

The lens is healthy and *in situ*. The vitreous has mostly disappeared. Situated at the posterior part, and extending from a point 3 mm. beyond the optic nerve on one side, to a point 2 mm. in front of the equator on the other side, is a flat unpigmented tumour 2.5 mm. in thickness, forming in the choroid, which at the edge of the growth is seen to split, one part going in front and the other part behind the tumour.

The retina is detached, both over the growth and at all other parts, and the subretinal space is filled with a large amount of coagulated albuminous material. The retina takes no part in the formation of the growth, but at one place it appears as if the neoplasm were invading this structure.

Microscopic Examination.—The growth is seen to be in the choroid, and splitting it near its edge, while the intermediate layers of connective tissue run into the tumour, and disappear. The mass consists of cells and connective tissue, but there is relatively little of the latter compared with the large amount of cells. It is in this interstitial tissue, which is evidently of choroidal origin, where the only pigment cells present are scattered; these cells are very few and far between, and they certainly form no intimate part of the tumour, which is entirely devoid of pigment. The parenchymatous portion of the neoplasm consists of large glandular epithelial cells, which are grouped together into masses and bounded by connective tissue; this, however, does not penetrate between the individual cells, which are grouped together by themselves. The vessels are few, and run entirely in the connective tissue meshwork.

In some sections the cells can be seen growing into

the adjacent retina, and the head of the optic nerve contains several processes of tumour cells which have been cut in section.

The sclerotic is quite unaffected, though a little round cell infiltration is seen at certain parts upon which the growth is resting.

There are numerous areas of degeneration in the growth, but owing to their somewhat broken up and unstained appearance it is difficult to say what they are composed of. In all of them migratory round cells are seen to be infiltrating.

CASE II.—The following case is one of considerable interest as bearing on this subject, and although it is not so complete as that first described, owing to the fact that no pathological examination could be made, yet there can be no doubt but that the patient was suffering from metastatic tumours of both eyes. For the notes, and for permission to publish the case, I am indebted to the kindness of Mr. A. E. Reynolds, under whose care the patient was, and to Mr. J. B. Lawford, who made the ophthalmoscopic examination.

The patient was a woman 44 years of age, who was operated upon 18 months before for carcinoma of the breast; this diagnosis was subsequently verified by microscopic examination.

In January, 1896, the following condition was noted. "Patient is a pale emaciated woman, with a dry skin, a hectic temperature, and a cough.

"There is very little headache, no ocular pain, occasional sickness after food or medicine, usually following coughing. There is a family history of tubercle. She has lately had 'pneumonia' of one lung, which has never quite cleared up. The urine contains no albumen. The right eye failed painlessly some weeks ago. The left eye failed 8—10 days ago, but the vision in this eye is said to vary considerably."

Present State.—"Right eye, tension normal, pupil acts very sluggishly to light, V. = less than J. 20. Left eye, tension normal, pupil acts well to light, V. = J. 8 fairly."

Ophthalmoscopic Examination.—"Right eye. All round the optic disc, and for some distance towards the periphery, the fundus appears grey, semi-opaque, and raised. The optic disc appears to lie in a hollow, and looks dark in contrast to the surrounding tissue. The retinal veins are large, not tortuous and not obscured. The arteries are about normal in size. No hæmorrhages, and no patches of exudation. The opaque area is unevenly hypermetropic, and the red reflex of the choroid quite lost. The media are clear."

"Left eye. There is a similar grey appearance over a large area up and in from the optic disc; the patch is very opaque and soft looking, and apparently swollen. The retinal vessels have much the same appearance as in the right eye. There are no hæmorrhages, the optic disc is not swollen, and the media are clear."

"No observations on the field of vision could be made. Patient was seen in her own room, and was too feeble to allow of any prolonged examination. She became quite blind soon after, but no rise of intraocular tension occurred. She died in August, 1896, but no post-mortem examination could be obtained. Death occurred from 'exhaustion.' No cerebral symptoms developed, and the vision at last was bare perception of light only."

This condition of secondary carcinoma of the eyeball is, I think, sufficiently rare to make it worth while to put such cases on record, and when one mentions the fact that until 1890 only five were to be found described in literature, and also that in the Moorfields museum there is only one somewhat doubtful case, it is pretty certain that this form of tumour may be regarded as among the most uncommon neoplasms met with.

Since 1890 several cases have been recorded, but still

the total number is so small that I venture to give an abstract of those which have been worked up and published, and in which there is undoubted evidence of the nature of the growth.

Doubtless many other cases have occurred, which have neither been examined nor published, and I feel sure that were eyes more frequently investigated in persons suffering from malignant tumours, we should find that the condition is less uncommon than would appear on looking at the literature on the subject.

Possibly the disease as it is here presented is of more interest to the pathologist than to the clinician, but as the former is almost entirely dependent upon the latter for his material, and as there is much room for work upon the subject of intraocular tumours, it is of the greatest importance that every case should be subjected to strict examination, if we are to elucidate the many perplexing cases upon which one is constantly asked to express an opinion.

Perls was the first to describe a case of this condition; and the report is published in Virchow's Archives, vol. lvi, p. 437. The patient died of primary carcinoma of the lungs and pleura, and at the autopsy the following condition was found in the eyes:—

Left Eye.—Retina detached on the inner and lower sides. Along the whole extent of the posterior half of the eyeball the choroid is 2 mm. thick, quite hard, and almost like cartilage, forming a slightly prominent uneven surface.

Right Eye.—There are several slightly prominent infiltrations, similar in appearance to the mass described above in the left eye. The retina is affected, and is perforated at some places. Under the microscope the masses are seen to be of the nature of the primary growth, and in the capillary layer of the choroid, near the infiltrations, there are enlarged vessels filled with carcinoma

cells, thus forming emboli. No mention is made of the condition of the eyes during life.

Microscopically Perls was able to trace a connection between the tubules filled with epithelial cells and the minute blood-vessels, thus showing that the metastasis was due to capillary embolism.

Hirschberg has reported two cases. The first is published in the *Centralblatt für praktische Augenheilkunde*, 1882, p. 376, and also in *Archiv für Ophth.*, 1884, Bd. xxx, Ab. 4, p. 113. The patient was a woman *æt.* 52, who came in August, 1882, complaining of failing sight. She had suffered for nine years from cancer of the right breast. The glands in the right and left supra-clavicular region were enlarged. Externally the eyes showed no changes, but the vision of the left eye was much reduced. Both fundi showed some small pale yellow spots close to the disc.

Six weeks later the right eye was still worse, and the ophthalmoscope revealed a similar condition in the two eyes, viz., a prominence of about 1 mm.

In November R.V. = fingers at 5', and the growth was 2 mm. high; the retina was extensively detached. The vision of the left eye had become much worse; the growth was especially marked above the optic nerve.

Later on the growth in the left eye also extended downwards from the papilla, so that on both sides there came to be a wall of new growth 12—15 mm. high. Along with this the vision rapidly failed, and then the growths began to shrink. There was never any pain in the eyes, and the tension was unchanged. Patient gradually got worse and died early in 1883, but no post mortem was allowed.

Schöler and **Uhthoff** (*Centralblatt für praktische Augenheilkunde*, 1883, p. 236) record a case of a woman, *æt.* 33, who suffered from carcinoma of the breast for six years. This had been removed as far as possible by operation. The right eye was first affected. The retina

in this was extensively detached, the papilla swollen, and the retinal vessels dilated. Around the papilla was a greyish-white ring containing epithelial nests. On the retina of the left eye, in the macular region, were numerous greyish-white dots, about the size of pins' heads, without pigment. They rapidly developed during the 10 months the patient was under observation. The left optic nerve became atrophied and the right eye glaucomatous.

The patient died shortly afterwards, when the condition was verified by Uthoff, who made the pathological examination. Metastatic growths were then found to be present in both pleuræ, both ovaries, both cerebral hemispheres, dura mater, both eyes, and right optic nerve.

The account of the autopsy is given in the *International Beiträge zur wissenschaftlichen Medicin*, ii, 1891, in a paper by Uthoff, "Zur Lehre von dem metastatischen Carcinom der Choroidea."

Hirschberg and **Birnbacher** (*Archiv f. Ophth.*, 1884, Bd. xxx, Ab. 4, p. 113) record the case of a woman 28 years of age, who had had the right breast removed in January, 1884, for scirrhus. A short time before the left eye had failed. When first seen the right eye was normal in every respect, but the left was totally blind. It was entirely free from pain, and the T. was -1 , and this condition remained throughout the whole course of the illness. Patient died in February, 1884.

At the autopsy a wound in the region of the right breast was healing, but in it were two small nodules of growth. There were nodules also found in the lungs, bronchial glands, and sheath of the liver and kidneys.

The eyeball on vertical section showed a large choroidal tumour, greatly diminishing the size of the vitreous chamber, and reaching as far forwards as the equator and backwards to the optic nerve. The retina was extensively detached by serous exudation. The base of the tumour measured 12 mm. long and 9 mm. in thickness.

The retina was funnel-shaped and in part adherent to the tumour.

Microscopically the cells were of a large spheroidal glandular shape, being collected into groups, which were separated from each other by means of connective tissue containing pigment. At places the retina was invaded by tumour cells.

The choroid in other parts was not altered in structure.

Manz (*Archiv für Ophthalmologie*, 1885, Bd. xxxi, Ab. 4, p. 101) describes the clinical appearances of a case of metastatic carcinoma of the eyeball which occurred in a woman *æt.* 50, whose right breast had been removed for cancer in August, 1883. She was first seen on account of failing sight in November, 1883, when the operation wound had not quite closed, but there was commencing local recurrence, and the axillary glands were enlarged. Her general condition was bad. There was a large detachment of the retina in the right eye, and a similar condition was seen in the left. The tension was not increased. Both detachments increased rapidly, and patient became blind. The tension of the left eye fell slightly, but this was the only change from normal. The patient left the Clinic, but died shortly afterwards of recurrences in the abdomen. No post-mortem examination was obtained.

A. Schapring (*American Journal of Ophthalmology*, 1888, vol. v, p. 285).

The case here recorded is that of a woman, a native of Germany, who was operated upon in 1885 for scirrhus of the right breast, the axillary glands being also removed. Microscopically the tumour proved to be a glandular carcinoma; the wound healed, and there was no local recurrence. In August, 1887, 22 months after the operation, she accidentally discovered that the sight of the left eye had almost gone. Her strength then began to fail, and she had much shortness of breath. In October, 1887, there was found to be much pleuritic effusion on the right side. In November about three pints of greenish-

yellow fluid was withdrawn from the chest, but it reaccumulated within two days. The patient speedily became worse, and died on December 27, 1887. The sight of the right eye was never impaired, and the tension of the left was normal throughout. A partial post mortem was made. The lower lobe of the right lung was permeated with numerous cancer nodules, and the rest of this lung and all the left had nodules less thickly scattered through them.

The liver was enlarged and hyperæmic, and contained numerous nodules similar to those found in the lungs. The stomach, heart, and pericardium were not affected. The left eye was removed, and after hardening was found to contain a flattened tumour on the temporal side. The choroid near the disc was much thickened, and composed entirely of carcinomatous tissue; further forwards on this side it got thinner and thinner, until it nearly reached the ora serrata, where it ended with a bevelled edge. A few carcinoma cells were formed on the nasal side of the optic nerve, but the choroid here was practically unaffected.

Mitvalsky (Archiv f. Augenheilkunde, 1889, Bd. xxi, p. 431). The case here reported was that of a woman æt. 46, who first noticed the sight of her left eye failing in February, 1886. The following is the history:—

A carcinoma had been removed from her left breast in 1884; a local recurrence, together with some enlarged glands, was excised. Since this time her condition has been good. When first seen, there were a large number of hard and enlarged glands in the axillary and clavicular regions, but no recurrence at the seat of the primary operation.

Ophthalmoscopically a vertical oval growth of 3 disc diameters extended laterally from the papilla to the macula. The retina became extensively detached in the course of a few weeks. Shortly after this the eye showed the symptoms of acute glaucoma, and the globe was

excised. The right eye remained unaffected, but the patient died, with symptoms of metastatic growths in the lungs and brain.

On examination the outer two-thirds of the choroid was replaced by a shell-shaped mass of a yellowish-grey colour, its greatest thickness being 2 mm. Microscopically the tumour presented the appearance of a carcinoma very like a scirrhus. It had numerous yellow spots, which did not stain, and which readily fell out when washed. The connective tissue framework showed everywhere choroidal pigment. The unstained areas were apparently formed of degenerated blood. The papilla was not involved in the growth. The angle of the anterior chamber was normal, but the chamber itself had much fibrous exudation in it.

The second case recorded in this paper is that of a man, *æt.* 35, who came in October, 1887, complaining of failing vision in the left eye. He had had good health until a year previously. He then noticed a tumour of the left breast. This was removed, together with the axillary glands. Microscopically it proved to be a scirrhus. Ophthalmoscopically an irregular vertical tumour was seen extending from the macula. Its greatest elevation was 4 diopters. *Tn. V.* = 6/60.

The growth developed rapidly, and patient died in December, 1887, with numerous metastatic growths, and with cerebral symptoms.

Gayet (*Archives d'Ophtalmologie*, 1889, p. 205) reports a case of carcinoma of the right eye occurring in a soldier, *æt.* 30, of alcoholic tendencies.

When first seen by the author the right eye was quite blind, as the result of a detachment of the retina. It was very injected, tender, and painful, and prevented his sleeping. The diagnosis of intraocular tumour was made, and the globe was excised.

On examining the eyeball after hardening, a large tumour of lenticular form was found touching the optic

nerve. Microscopically it was found to be composed of cylindrical shaped epithelium. The patient died shortly afterwards, with very marked abdominal symptoms. The post mortem revealed a large tumour of stomach, liver, and right lung.

V. Kamocki (Archiv für Augenheilkunde, Bd. xxvii, p. 46), reports a case which he had several years before published, as one of adenoma of the choroid. The eye, R., T. +, containing the growth, was removed in March, 1884. The patient was a man, æt. 37, who had always been strong and healthy. The eye began to fail about a year before excision, and for four months had been quite blind. The retina was completely detached, but the ciliary body and anterior part of the choroid were normal. Surrounding the optic nerve was a sharply defined tumour 5 mm. in height, and 18 mm. in lateral extent. In section the growth showed an alveolar structure.

Microscopically the tumour consisted of glandular tissue, at some places resembling the lacrimal gland, and at others the thyroid. The epithelial cells were mostly cylindrical, and arranged in a single stratum. The peripheral portions had a structure like that of an acinotubular gland. The stroma consisted of fibrous tissue, containing numerous choroidal pigment cells.

Preparations from the central portions of the tumour closely resembled a cystoma of the ovary. These cavities were lined with flattened epithelium, and filled with colloid masses. From its close resemblance to other published cases of metastatic carcinomata of the choroid, and especially from its great similarity to Gayet's case, which was secondary to carcinoma of the stomach, the author is strongly of opinion that this arose in a similar manner. This, however, cannot be proved, but it was ascertained that shortly after the patient left the hospital he became ill, and died in a few weeks, but without receiving medical attention.

Schultze (Archiv für Augenheilkunde, vol. xxi, 1890,

p. 319) reports the case of a woman, æt. 34, who was seen in 1888, and who had noticed the sight of the left eye failing for about three months, accompanied latterly with pain and lachrimation. The external appearance of the eye was healthy. V. = 5/6. T. normal.

Ophthalmoscopically a detachment of the retina was observed at the upper and outer part of the left fundus, but nothing like a tumour was seen.

The patient had been operated upon for carcinoma of the right breast in December, 1887, at which time the axillary lymphatic glands were removed.

In September, 1888, the blind eye was removed. The patient died five months later from recurrence in the nervous system, though no autopsy was allowed.

On examination of the eyeball the retina was found to be entirely detached and the vitreous much shrunken.

In the upper half of the eyeball there was a flat choroidal tumour lying on the sclera. It reached from 4 mm. behind the ciliary body, and extended backwards so as to overlap the entrance of the optic nerve. The measurements of the tumour were 19 mm. × 16 mm., and its thickness was 5 mm. On the opposite side was another smaller deposit, 5 mm. broad and 2 mm. thick.

Microscopically the tumours were shown to be of the same nature. The ground substance was composed of connective tissue containing numerous pigment cells, while the bundles of fibres enclosed groups of spheroidal epithelial cells. The vessels were not very numerous, and there were various patches of necrosed tissue; in these spaces was a good deal of blood.

A. E. Ewing (Archiv für Ophthalmologie, 1890, Bd. xxxv, Ab. i, p. 120) records a case of metastatic carcinoma of the choroid occurring in an unmarried woman æt. 32. She was first seen in October, 1887. The sight of the right eye had been failing for two months, T. + 1. The retina was detached, and a growth could be seen at the base of the iris extending backwards into the ciliary body.

Ophthalmoscopic examination revealed a detachment of the retina, and a tumour spreading forwards into the ciliary body.

The eye was excised in November, 1887.

A carcinoma was then found in the left breast, about the size of an apple.

At the end of December patient complained of dimness of vision of the left eye. A detachment of the retina was seen, and this rapidly increased in size. On examining the right eye after removal, a transverse section showed complete detachment of the retina and a gradual thickening of the choroid in every direction from the optic disc to the equator, but nowhere was the tumour more than 1.5 mm. in thickness.

Microscopically the growth consisted of epithelial cells arranged in an alveolar manner in a connective tissue network. Numerous vessels were blocked with the cells of the new growth.

The following clinical case is recorded by **C. Guende** (*Recueil d'Ophthalmologie*, 1890, p. 325). Emma X, æt. 54, attended the clinique of Dr. Despagne in November 14, 1889, complaining of visual tremble in the right eye, following an injury with an umbrella nine months previously.

For six months there had been repeated inflammatory attacks of periorbital pain and lacrimation. On examination there was found to be intense ciliary injection, diminished tension, and other symptoms of cyclitis. Ophthalmoscopic examination showed an ill-defined detachment of the retina of +6.0 D. The retina itself was greyish in colour. The patient had a cachectic appearance.

For nine years she has noticed a tumour at the lower part of the right breast. It had increased much, and had now become ulcerated.

By the end of February, 1890, patient had become very thin and emaciated, and was confined to her bed for

the greater part of the day. The eye again became inflamed, soft, and tender to the touch. The right temporal region had numerous blackish veins, very like that seen in some cases of tumour of the brain.

On examination there were found to be undoubted signs in various parts of the body of neoplastic growths, in the skull, sternum, clavicles, some of the upper ribs, and in the fingers.

The right breast, which was the seat of the primary growth, was entirely occupied by a hard mass the size of a fist, ulcerated at its lower part, and adherent to the pectoralis major. The left breast had a smaller tumour and the axillary glands were greatly increased in size. The liver was tender and enlarged, but she had never been jaundiced. The digestion was deranged, and there was frequent vomiting. The breast, the lungs, and the whole nervous system showed signs of being involved, and the patient became extremely weak.

In order to examine the breast tumour Guende removed a small piece, but unfortunately the examination proved inconclusive.

The mother of the patient died of cancer.

A. Elschnig (Archiv für Augenheilkunde, Bd. xxii, p. 149) reports the case of a woman, æt. 57, who, in February, 1887, was operated upon for carcinoma of the left breast. Shortly afterwards a local recurrence took place. She first complained of failure of the sight of the left eye in December, 1887. Ophthalmoscopically there was seen to be a detachment of the retina, and this rapidly advanced, until in less than a month it became completely detached. The intraocular tension soon became increased, and there was much injection of the eyeball. The glaucomatous condition continued until March, 1888, when the patient died from exhaustion, with metastatic growths in the brain, lungs, and liver.

The affected globe was removed, hardened in Müller's fluid, and presented the following condition:—

The lens and iris were pushed forwards, the retina was completely detached, and the subretinal space was filled with coagulated albuminous material. The choroid near the disc was twice its natural thickness, of a mottled light brown colour, and sharply defined from the dark, atrophic, unthickened choroid.

Microscopically the tumour was seen to be composed of dense fibrous tissue, containing pigment cells and a few blood-vessels. These bundles enclosed tubules of small epithelial cells, in many of which were cavities filled with degenerated matter or red blood corpuscles. Two venæ vorticosæ which were examined had their lumen occluded partly by proliferated endothelium, and partly by epithelial groups lying in masses of coagulated blood, portions of which had undergone calcareous degeneration.

O. F. Wadsworth (Trans. American Ophth. Soc., 1890, vol. v, p. 654). This case is that of an unmarried woman, æt. 46, who was first seen on June 14, 1890, having had a dimness of sight for three weeks. There was a large detachment of the lower part of the retina. In order to determine whether a tumour was present or not a needle was thrust into the eyeball through the detachment. The point could be seen with the ophthalmoscope, and distinct resistance was felt to lateral movement; this settled the diagnosis of tumour.

The previous history was that, 16 months before, the right breast had been removed for cancer, which, however, was not microscoped.

On June 26 the vision was reduced to P.L., and there was no fundus reflex. The eyeball was enucleated, and examined after hardening. The following condition was found.

The vitreous was stained with blood. The tumour, which was situated in the choroid, was light in colour, moderately firm, nearly circular, with a smooth surface. It measured superficially 10 × 12 mm. and 3 mm. in thick

ness. At the anterior part of the growth and forwards to the ora serrata the retina was loosely detached, but it was *in situ* at all other parts.

Microscopically the tumour consisted of masses of cubical and irregular-shaped epithelial cells, with areas of hyaline degeneration. It was situated in the choroid, but had invaded the inner layers of the sclerotic; the retina, however, was not involved. The subsequent history is not given.

Uhthoff (International Beiträge zur wissenschaftlichen Medicin, 1891, Bd. ii). In an article in this volume, entitled "Zur Lehre von dem metastatischen Carcinom der Choroidia," Uhthoff describes the case of a woman, æt. 47 years, who was first seen on January 6, 1890, complaining of failing sight. She had had a carcinoma of the right breast operated upon in May, 1889.

The vision of the right eye was 14/200, and of the left 3/200; in the right eye the upper half of the field was gone, and in the left there was a large central scotoma. Both retinae were extensively detached. Patient became comatose, and died on February 19, 1890.

An autopsy was made by Dr. Oestreich the following day. There was a local recurrence in the right breast. There were also metastatic growths in the liver, spleen, kidneys, bronchial glands, retroperitoneal glands, right suprarenal capsule, right temporal lobe, and in the choroid of both eyes.

Carl Wagner (Ueber metastatische Aderhauttumoren, published in 1891 by Gustav Schröter) describes the following case:—

On April 24, 1890, a man, æt. 45, came to the University Eye Clinic, at Halle, complaining about the left eye, which was blind; the conjunctiva was injected and chemotic. The cornea, aqueous, and lens were clear. The retina was entirely detached. Tension +. R. eye normal. Sarcoma of choroid was diagnosed, as there was nothing to indicate carcinoma. Excision was advised, but

patient would not consent until four months later, when the eye was removed.

On section, a flat tumour, about 2 mm. in thickness, was observed which had an extremely uneven surface. The retina was detached.

Patient then gave the following history:—

A year and a half previously the sight began to fail, and since then he had had several attacks of acute glaucoma. He was seen by Schwalbe, who found the eye inflamed, painful, and blind. The retina was detached. In November, 1888, he attended a clinic at Leipsig, when a tumour the size of a pea was seen on the nasal side by means of focal illumination.

Two days after the operation, patient was carefully examined, when everything was found normal except the liver, which was enlarged and painful on pressure. Four months later patient again attended complaining of pain in the hepatic region. He was cachetic in appearance and had swollen glands in the neck, right axilla, and inguinal region. There was a distinct tumour of the liver, which had an uneven surface, and reached as low as the umbilicus in the middle line. There was slight ascitis.

Pathological Examination of the Eye.—The angle of the anterior chamber was closed. The sclera was normal. Close behind the equator a tumour the size of a pea was seen connected with the choroidal growth. The growth itself was flat and shell-like in shape, and was nowhere more than 2 mm. in thickness. Microscopically the tumour was found to be composed of round or polygonal cells with round nuclei; they were arranged in an alveolar manner, while at places the cells were degenerated.

The patient died subsequently of cancer of the stomach and liver, but he was not under observation at the time, and no post mortem was obtained; consequently it is doubtful if the growth in the eye was primary or secondary.

The slow course of the disease, however, was very suggestive of the stomach being the primary source.

Ward A. Holden (Archives of Ophthalmology, 1892, vol. xxi, p. 76) reports a case of carcinoma of the eyeball, but the clinical history of the patient, from whom the eye was removed, was lost, therefore nothing but the anatomical and histological appearances are described. On opening the globe the retina was found detached on the temporal side from the papilla to the ora serrata, and the subretinal space was filled with a coagulated albuminous mass. Beneath this was a flat growth in the choroid 1.5 mm. thick.

In the outer layers of the sclera and in the episcleral tissue, at a point corresponding to the middle of the choroidal growth there was a small tumour consisting of narrow epithelial tubules, but it was separated by unchanged sclera from the other growth.

Again, at a point 4 mm. to the nasal side of the papilla a few carcinoma tubules had developed in the choroid without causing any perceptible thickening. There were thus three distinct foci.

That these three tumours were of metastatic origin is proved by the fact that two of the three deposits occur at a situation in which primary carcinoma does not occur, and this is also confirmed by their position with reference to the arteries.

The smaller choroidal focus appeared in that portion of the choroid to which the short ciliary arteries of the nasal side run. The middle portion of the larger choroidal focus was in that part of the choroid where the greater number of the short ciliary arteries enter.

The scleral focus was in the situation of the small twigs which, after being given off by the short ciliary arteries run near the surface of the sclera.

S. Schultze, (Archiv für Augenheilkunde, Bd. xxvi, 1893, p. 19) reports the case of a lady, æt. 39, who was in good health until August, 1889. She was at that time

suffering from subacute catarrh of the lungs. She had repeated pulmonary hæmorrhages, but no consolidation could be found, and there was no fever. In December she developed an empyæma, and 4—5 litres of seropurulent fluid were removed.

In February, 1890, the sight of the left eye began to fail, and in the course of six weeks it became blind and painful.

In May the eye was enucleated, as a tumour was suspected. Her general condition did not improve, and the pleural cavity was again aspirated. She died of marasmus in September, 1890, this being nine months after the chest symptoms developed.

During life malignant disease of the lungs and pleura was diagnosed, but an autopsy was not permitted.

The eye containing the growth was healthy in its anterior part. Growing in the choroid, and reaching from the optic disc to a point a few millimetres behind the ciliary processes, was a flat, nodular growth, measuring from 17—20 mm. in all directions, and 3 mm. in its thickest part, which gradually became thinner as it passed into the normal choroid. The sclerotic had become perforated, and near the optic nerve a small round tumour had developed outside; this measured 6 mm. laterally, and 4 mm. in height. A narrow tumour mass passed through the sclerotic, and united the two.

Microscopically the growth had an alveolar structure, being composed of large and small cell nests of varying form, situated in a stroma of connective tissue containing many choroidal pigment cells. The carcinoma cells, and many of the nests had both old and recent hæmorrhages. The growth outside the globe was similar in structure, but contained much dense connective tissue, the nests contained no hæmorrhage, and there were no pigment cells in the stroma.

The choroidal vessels contained no emboli of cancer cells, but in the sclera many vessels were occluded by them,

and a posterior ciliary artery was plugged by a carcinomatous embolus for some distance.

The patient died of marasmus, nine months after the chest symptoms first commenced to develop, seven months after the first disturbance of vision, and four months after the eye was removed.

No post mortem was permitted, but the diagnosis made during life was that of cancer of the lung and pleura.

G. Abelsdorf, (*Archiv für Augenheilkunde*, 1896, vol. xxxiii, p. 34) reports a case of a woman, *æt.* 44, who complained that for three weeks the sight of both eyes had been affected.

Ophthalmoscopic examination revealed in the left eye a flat detachment of the retina on the temporal side, and in the right eye a detachment near the yellow spot. The tension of both was normal.

A primary carcinoma was discovered in the right breast, which had been growing for a year. The patient died three months later.

On section of the right eye there was a diffuse thickening of nearly the whole of the choroid. It began around the disc and passed gradually into the normal choroid near the ora serrata. Its greatest thickness was 2.5 mm.

The retina was completely detached and the subretinal space filled with coagulated masses.

Microscopically the tumour had a typical carcinomatous structure. The parenchyma was composed of connective tissue forming alveoli which were filled with epithelial cells, the connective tissue at parts contained fixed and pigmented cells together with free pigment. The tumour also contained necrosed tissue, degenerated cells, free pigment, many red blood corpuscles, and small blood-vessels. At some points the capillaries of the choroid were surrounded with carcinomatous tissue, but they contained no emboli of carcinoma cells, whereas many emboli were present in the posterior ciliary arteries near their passage through the

sclerotic. The optic disc was infiltrated with epithelial cells, and so also was the root of the iris in the ciliary body at its lower and temporal side; these passed through the filtration angle into the anterior chamber and invaded the circular fibres of the ciliary muscle.

The microscopic appearance of the left eye was much the same as that of the right. No direct connection existed between the iritic and the choroidal tumours.

Henry D. Noyes (Trans. American Ophth. Society, 1897, p. 538) reports the case of a patient, *æt.* 55, who was seen on September 5, 1895. She was a stout and well nourished woman who had undergone two operations for cancer of the right breast, once in 1880 and again in 1889. In 1893 she had a uterine tumour removed, but it is not known if this was of a nature similar to that in the breast.

Ophthalmoscopic examination of the right eye showed a few vitreous opacities, and in the middle of the fundus a detachment of the retina was visible. Ten weeks later the detachment was much more marked and the lower half of the retina also.

In May, 1896, the eye was excised on account of pain. On section a growth in the choroid was found, reaching from the optic nerve nearly to the equator, its thickness was 1.5 mm.; the retina was totally detached.

On microscopic examination "the thickened choroid presents numerous connective tissue trabeculae, lightly pigmented, enclosing numerous alveoli of various sizes. These alveoli are partly or wholly filled with cells which resemble epithelial cells. In many places the alveoli are only lined with these cells, the rest of the space being partly filled with fibrin. There are few vessels in this part, the vessels of the choroid proper being much reduced in size, and crowded into the anterior or posterior side of the new formed tissue. About the optic nerve entrance the alveoli are quite small and well filled with new cells."

George H. Matthewson, at the Annual Meeting of the British Medical Association held at Montreal, 1897, reported a case of metastatic adeno-carcinoma of the choroid. The patient was a lady, æt. 48, who came to Dr. Buller complaining of almost complete blindness of the right eye of about three months' duration. The lower part of the retina was seen to be detached. Buller then made a scleral puncture, and drew off a considerable quantity of serous fluid, and found next day that the retina had gone back, but that at a short distance below the optic nerve there was a small flattened ovoid swelling. There was a large firm nodular tumour of the thyroid, and the diagnosis of malignant growth of that gland with metastasis of the choroid was made. The thyroid was extirpated, and the right eye was enucleated. On opening the eye, a small flat ovoid tumour with roughened surface was found immediately below the optic nerve. Microscopically it was seen that the growth was chiefly in the choroid, the sclera and optic nerve being invaded to a slight extent by tumour cells, while the retina was unaffected. The minute structure of the thyroid tumour, and also of that in the eye, showed that it was a glandular carcinoma.

Of the 24 cases here recorded, 18 were females and 5 were males, while in 1 case, No. 13, the clinical history was entirely lost.

Most of these cases occurred in middle-aged persons. The youngest recorded age at which the disease appeared was 28. This case (No. 4) was recorded by Hirschberg and Birnbacher. The patient suffered from carcinoma of the right breast. The two oldest cases were æt. 57. One of these (No. 14), recorded by Elschnig, was that of a woman who suffered from cancer of the left breast, and the other one was the first of the two cases which have formed the basis of this paper. No. 23 in table.

The tension of these eyes forms an interesting feature.

It was normal in	11 cases.
„ + „	7 „
„ — „	4 „
„ not recorded in	8 „

Total .. 30 eyes for 24 persons.

Here we see that the usual condition is to have normal tension, and the least common minus tension. These cases differ in this respect from the ordinary sarcomata which affect the choroid. In a paper by the author, published in the Ophthalmological Society's Transactions for 1896, on the subject of tension in cases of intraocular tumour, it was shown that of the cases in which the ciliary body was not affected, 67·92 per cent. had increased tension and 30·10 normal tension.

The difference, however, is not surprising when one considers the anatomical peculiarities of these tumours.

These growths are nearly always flat and thin, and consequently they are less likely to lead to the pushing forwards of the lens and iris, and to the blocking of the angle of the anterior chamber, as is so notably the case in eyes containing choroidal growths far back.

With regard to the position of the primary growth, it is at once apparent what a large proportion of the patients suffered from carcinoma of the breast; of the 24 cases, 17 suffered from this disease, one being a male and the rest females.

One male, Case 1, and one female, Case 10, suffered from primary cancer of the lung and pleura.

The three who had cancer of the stomach were all males.

One case, No. 22, suffered from primary cancer of the thyroid, and in one case, No. 18, both the sex and the seat of the primary growth were unknown.

The times during which the patients have lived after the first symptom of the eye having become diseased is very variable, and is really a somewhat unimportant fact, depending, as it must, on a variety of accidental circum-

stances. The usual span of life in these cases is a few months. The longest period of time recorded is in Case 17, by Wagner, in which the patient lived for two years, while the shortest is about a month in Cases 4, 5, and 11.

When one considers the anatomical position of the structures involved, it is hardly surprising to find that malignant metastatic deposits in the eye are very uncommon.

One of the most marked features concerning the dissemination of carcinomata is the readiness with which the lymphatic system becomes involved. The lymphatic glands in the neighbourhood of the primary growth are practically always the first to become affected, and it is frequently only at a late stage that there is positive evidence of the vascular system having become the means of carrying the tumour cells to distant parts of the body. Now it is quite certain that the eye can only become involved through the vascular system, as there is no lymph stream running from, say, the breast or the stomach to the eye. Consequently, one would expect that this organ would but rarely become affected, and that only in the later stages of the disease.

This is exactly what we find in the majority of cases. If, therefore, there is reason to suspect the presence of

No. of case.	Author.	Where published.	Sex.	Age.	R. or L.	Tension.
1	Perls	Virchow's Archiv, Bd. 56..	M.	43	R. and L.	..
2	Hirschberg ..	Centralbl. f. prak. Augen- heilkunde, 1882, p. 376.	F.	52	R. and L.	R. n. L. n.

a tumour in the eye of a patient suffering from carcinoma elsewhere, it should at least put us very much on the lookout for confirmatory evidence of metastasis in other parts of the body, and of general dissemination of the growth.

As far as treatment is concerned, in such cases it can obviously be only palliative, as it is hopeless to imagine that internal organs are unaffected if the eye is already involved. On the other hand, there is absolutely no reason why such eyes should not be removed; they are liable to attacks of acute glaucoma, and may, if they ulcerate, become extremely painful, whereas excision at an early stage involves practically no risk, and at least one source of discomfort is done away with, while the patient loses but a useless organ.

In conclusion, I have to express my indebtedness to Mr. Couper for giving me the eye to examine from Case 1, and to Sir William MacCormac for his notes concerning the previous history of the case.

I have to thank Mr. A. E. Reynolds and Mr. Lawford for placing the notes of Case 2 at my disposal, and for kindly allowing me to publish it.

My thanks are also due to Dr. Gordon Byers for his assistance in helping me to work up the literature of the subject.

Pathological examination of eyeball.	Seat of primary growth.	Seat of secondary deposits other than eye, and result of post mortem, if obtained.	Duration of life after eye was first affected.	Remarks.
Flat shell-like growth in choroid 2 mm. in thickness.	Lung	Various internal organs.		
Eyes not removed.	Carcinoma of R. breast.	Unknown. No post mortem obtained.	About 7 months.	

No. of case.	Author.	Where published.	Sex.	Age.	R. or L.	Tension.
✓ 3	Schöler and Uthoff	Centralbl. f. prak. Augenheilkunde, 1883, p. 236.	F.	33	R. and L.	R. T. + 1 L. T. n.
✓ 4	Hirschberg and Birnbacher	Græfe's Archiv f. Ophth., 1884, Bd. 30, Ab. 4, p. 113.	F.	28	L.	T. - 1
✓ 5	Manz	Græfe's Archiv f. Ophth., 1885, Bd. 31, Ab. 4, p. 101.	F.	50	R. and L.	R. T. n. L. T. - 1
✓ 6	Schapringer ..	American Jour. of Ophth., 1888, vol. 5, No. 10, p. 285.	F.	51	L.	T. n.
✓ 7	Mitvalsky ..	Archiv f. Augenheilkunde, 1889, Bd. 21, p. 431.	F.	46	L.	T. + 2
✓ 8	Mitvalsky ..	Archiv f. Augenheilkunde, 1889, Bd. 21, p. 431.	M.	35	L.	T. n.
✓ 9	Gayet	Archiv. d'Ophthalmologie, 1889, p. 205.	M.	30	R.	..
10	Kamocki ..	Archiv f. Augenheilkunde, 1893, Bd. 27, p. 46. (Case published several years before elsewhere as ademona of choroid.)	M.	37	R.	T. +

Pathological examination of eyeball.	Seat of primary growth.	Seat of secondary deposits other than eye, and result of post mortem, if obtained.	Duration of life after eye was first affected.	Remarks.
R. greyish-white ring around the optic disc. L. flat tumour of choroid 1 mm. thick.	Carcinoma of breast. Removed.	Post mortem subsequently made by Unthoff. Recurrences found in both eyes, R. optic nerve, both pleuræ, both ovaries, both cerebral hemispheres, dura mater.	1 year.	
Large choroidal tumour reaching from equator to O.D., base 12 mm., and thickness 9 mm.	Carcinoma of R. breast, which was removed.	Lungs, bronchial glands, sheaths of liver and kidneys.	About 1 month.	
Eyes not removed. Retina in both detached.	Carcinoma of R. breast, which was removed.	Recurrences in abdomen, but no post mortem made.	About 1 month.	
Flat metastatic tumour of choroid.	Carcinoma of right breast.	Lungs and liver ..	4 months.	
Flat shaped tumour of choroid at outer part 2 mm. in thickness.	Left breast, which was removed.	Growths in lungs and brain.	3 months.	
Irregular oval tumour reaching 4 disc diameters outwards from disc. Eye not removed.	Left breast ..	Growths in cranial periosteum and brain. No post mortem.	2 months..	Patient died with cerebral symptoms.
Large tumour of choroid, lenticular in shape, touching the optic nerve, composed of cylindrical shaped epithelium.	Stomach ..	Lung, liver	A few months.	
Tumour surrounding O.N. base 18 mm. long, height 5 mm. Cylindrical shaped epithelial cells.	? Stomach ..	No post mortem made.	Rather more than one year.	As patient died with abdominal symptoms, and as the tumour cells resemble those of stomach, it is supposed that he was suffering from cancer of stomach, to which eye tumour was secondary.

No. of case.	Author.	Where published.	Sex.	Age.	R. or L.	Tension.
✓ 11	Schultze. . .	Archiv f. Augenheilkunde, 1890, Bd. 21, p. 319.	F.	34	L.	T. n.
✓ 12	Ewing . . .	Graefe's Archiv f. Ophth., Bd. 36, Ab. 1, p. 120.	F.	32	R. and 4 months later in L.	T + 1 T + 1
✓ 13	Guende . . .	Recueil d'Ophthalmologie, 1890, p. 325.	F.	54	R.	T -
✓ 14	Elschnig . . .	Archiv f. Augenheilkunde, 1890, Bd. 22, p. 149.	F.	57	L.	T +
✓ 15	Wadsworth . . .	Trans. Amer. Ophth. Soc., 1890, vol. v, p. 654.	F.	46	..	..
✓ 16	Uhthoff . . .	International Beitr. zur wissenschaftlichen Me- dicin, 1891, Bd. 2.	F.	47	R. and L.	..

Pathological examination of eyeball.	Seat of primary growth.	Seat of secondary deposits other than eye, and result of post mortem, if obtained.	Duration of life after eye was first affected.	Remarks.
Flat choroidal tumour in upper half of eyeball, reaching from 4 mm. behind ciliary body to O.N. It measured 19 mm. by 16 mm., and 5 mm. in thickness. On opposite side a second smaller deposit 5 mm. broad and 2 mm. thick.	Carcinoma of right breast.	Nervous system, but no autopsy was obtained.	5 weeks.	
R. choroid thickened in every direction from optic disc to base of iris, nowhere more than 1.5 mm. in thickness. Microscopically it was a glandular carcinoma.	Left breast.			
.. .. .	Right breast ..	Skull, sternum, clavicles, upper ribs and fingers, liver, lungs, heart and nervous system.	..	Clinical observation only.
Choroid near disc twice its natural thickness. Microscopically tubules of epithelial cells in a pigmented ground substance.	Left breast ..	Brain, lungs and liver.	3 months ..	Eye removed after death.
Flat tumour measuring 10 x 12 mm. and 3 mm. thick. Consisted of masses of cubical epithelial cells with areas of hyaline degeneration involving sclerotic.	Right breast.			
Flattened tumours in both eyes.	Right breast ..	Liver, spleen, kidneys, R. suprarenal body, retroperitoneal glands, bronchial glands, lungs, R. temporal lobe.	A few months.	

No. of case.	Author.	Where published.	Sex.	Age.	R. or L.	Tension.
17	Wagner, C. ..	Ueber metastatischer Ader- hauttumoren, Halle, 1891.	M.	45	L.	T. +
18	Holden, W. A. . .	Archives of Ophth., 1892, vol. xxi, p. 76.	..	..	..	..
✓ 19	Schultze. . .	Archiv f. Augenheilkunde, 1893, Bd. 26, p. 19.	F.	39	L.	..
✓ 20	Abelsdorf ..	Archiv f. Augenheilkunde, 1896, Bd. 33, p. 34.	F.	44	R. and L.	T. n.
21	Noyes, H. D. ..	Trans. Amer. Ophth. Soc., 1897, p. 538.	F.	55	R.	T. slightly -
✓ 22	Matthewson ..	Montreal Meeting of British Medical Asso- ciation, 1897.	F.	48	R.	..
✓ 23	Author's 1st case	Present paper	F.	57	R.	T. n.

Pathological examination of eyeball.	Seat of primary growth.	Seat of secondary deposits other than eye, and result of post mortem, if obtained.	Duration of life after eye was first affected.	Remarks.
Flat tumour of choroid 2 mm. in thickness. Tumour cells are round and polygonal.	Probably stomach	Glands of neck, axilla and inguinal region, liver. No post mortem obtained.	About 2 years.	Clinical history entirely lost.
Flat growth of choroid 1.5 mm. Also small tumour on outer side of sclerotic, but not connected with larger growth. Also a separate small growth in choroid.			..	
Flat nodular tumour of choroid 20 × 17 mm. and 3 mm. thick. Sclerotic perforated near O.D., and a tumour 6 × 4 mm. outside sclerotic, connected with the intraocular growth.	Probably lung and pleura	Unknown, probably metastatic growth in abdomen.	7 months.	
R. flat tumour of choroid around disc, and extending forward 2.5 mm. in thickest part. Another small growth at base of iris. The left eye shows a similar condition.	R. breast ..		4 months.	
Flat tumour reaching from O.D. to equator 1.5 mm. thick.	R. breast			
Small flat ovoid tumour with roughened surface immediately below optic nerve.	Thyroid ..		Still alive.	
Flat tumour extending from 5 mm. beyond O.N. on one side to 2 mm. in front of equator on the other. Growth is 2.5 mm. thick.	R. breast ..	In abdominal viscera, but no post mortem obtained.	20 months.	

No. of case.	Author.	Where published.	Sex.	Age.	R. or L.	Tension.
✓ 24	Author's 2nd case	Present paper	F.	44	R. and L.	T. n. in both

Pathological examination of eyeball.	Seat of primary growth.	Seat of secondary deposits other than eye, and result of post mortem, if obtained.	Duration of life after eye was first affected.	Remarks.
.. .. .	Breast ..		About 9 Months.	Right eye failed slightly before left. Patient had "pneumonia" some months before death. She died from "exhaustion," and had no cerebral symptoms. No post mortem obtained.

CONCOMITANT STRABISMUS: THE ACCESSORY ADDUCTORS AND ABDUCTORS.

By J. HERBERT FISHER, M.B., B.S. (Lond.).

IN speaking of the movements of the eyes we are constantly meeting with the statement that pure lateral movements of adduction and abduction are effected by the isolated action of the internal rectus and external rectus muscles respectively. This is a statement to which I think few anatomists and physiologists agree, and which few ophthalmologists on consideration really, I believe, would accept. It is in the first place contrary to our knowledge of the behaviour of muscles elsewhere in the body; in the movement, for example, of elevation of the hyoid bone and larynx, muscles such as the two digastrics and stylohyoids are provided to do the work which at first sight a single vertical muscle could effect, seeing that no lateral deviation of these mid-line structures of the neck is required or allowed; the movement restoring the hyoid bone and larynx to their positions of rest is carried out by the muscles of depression, the sternohyoids, and sternothyroids, neither of which run in the vertical direction, and by the digastric muscles, the omohyoids. We learn that these arrangements secure steadiness of action, and accept it as a satisfactory explanation, because it accords with our general examination and experience of muscles elsewhere in the body. Do we then really believe that Nature has been so remiss as to provide a single straight muscle to act alone in effecting a movement where delicacy, accuracy, and steadiness are perhaps more essential than any other of which we are capable? Still the fallacy is perpetuated in text-books, and, it seems to me, leads us into greater difficulties. We learn that in uncorrected hypermetropia the inability to dissociate the action of the converging internal recti from

the action of the ciliary muscles and pupillary sphincters results, especially when the correcting influence afforded by binocular vision is from any cause reduced, in preponderance of the internal recti and convergent strabismus; when, however, in high myopia the incentive to convergence is that in order to get clear images the patient holds objects close to his eyes, we accept the statement that the internal recti refuse to respond to this stimulus, or if they do so for a time and have presumably, in consequence of much use, hypertrophied, in time of tribulation they fall away, and, declining further to make the efforts required, divergent strabismus is the result. Insufficiency of the adductors to maintain convergence in times when the general health is enfeebled we may believe, but insufficiency of these hypertrophied adducting muscles to maintain the parallelism of the primary position against abducting external recti which, like the myopes ciliary muscle are probably atrophic from diminished use, is hard to accept. It comes to this, that in over use from one cause the internal recti hypertrophy and give rise to convergence, while in over use from another cause they perversely become enfeebled and allow divergence, when in either case binocular vision is impaired.

We are led into these difficulties from regarding the lateral recti as the sole agents in providing pure lateral rotation of the eyes. There is, to my mind, no doubt whatever that the superior rectus and inferior rectus passing from their origins forwards and outwards to their insertions in front of the centre for lateral movement of adduction, can and do contribute to this movement, whether it be effected for convergence or in association with abduction of the fellow eye. In acting together the tendency of the superior rectus to elevate the cornea is neutralised by the tendency of the inferior rectus to depress it; the rotation of the globe on the antero-posterior axis which the superior rectus tends to provide (wheel-

like movement towards the nose) is counteracted by the opposite rotation on the same axis attempted by the inferior rectus.

Superior rectus. . Elevator. Internal rotator . . Adductor.
Inferior rectus . . Depressor. External rotator. . Adductor.

The quota of adduction contributed by each remains, when both act together, to supplement that of the pure adductor, the internal rectus. Here then we have three good muscles, all innervated like the ciliary muscle and sphincter pupillæ by the third nerve, to effect steadily and with precision the most important movement of converging the eyes on a near point. A control on their action is of course provided by the abductors, just as we do not flex our forearm with the biceps and its assistants without at the same time throwing into action the triceps and other extensors.

The movement of abduction, similarly tabulating the muscle actions, is seen to be performed by the two obliques with the external rectus—the pure abductor.

Superior oblique. . Depressor. Internal rotator . . Abductor.
Inferior oblique . . Elevator. External rotator. . Abductor.

The movement of abduction, being one only of restitution, is effected, it may be noted, by one muscle supplied by the third nerve, one by the fourth nerve, and one by the sixth nerve.

With the eyes at rest in the primary position we must, I think, assume that the tone of the adductors is exactly balanced by that of the abductors; if not, movement would result; the statement is also probably true that the work done in adducting the eye 1° is equal to that done in abducting it to the same extent, though, without some means of estimating the resistance offered to the two movements, I do not think it is capable of proof; but in the position of rest, whether that be one of parallelism of the eyes or of divergent or convergent

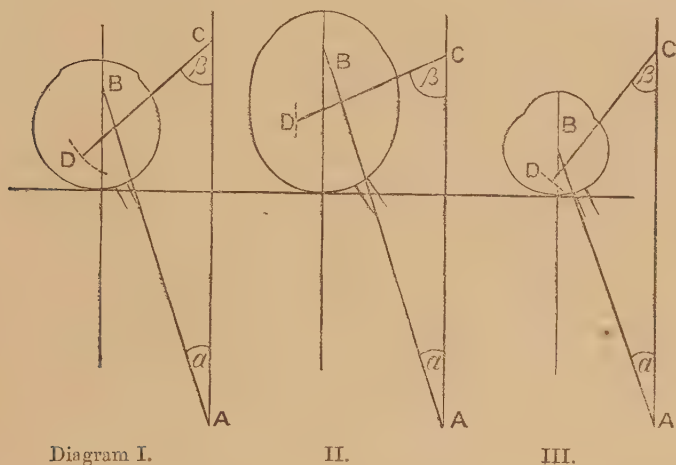
strabismus, the adductors and abductors are balancing one another. Let us take the case of divergence of axes of the two eyes; it is admitted by all that tenotomy of the external rectus will do less towards correcting a divergent strabismus than tenotomy of the internal rectus will do for a convergent strabismus; regarding the lateral recti as the sole agents of lateral movement, the normally more powerful adductor, attached also at greater advantage (nearer the sclero-corneal junction), when its antagonist is divided and it is unopposed, will do less to supplement our efforts than its more obliging though feebler fellow under similar circumstances. This apparent paradox is explained by our recognising that when the external rectus has been divided, the superior and inferior obliques together retain a considerable amount of abducting power, so that the adductors are not left unopposed; when the internal rectus has been tenotomised the superior and inferior rectus in the same way still oppose the abductors somewhat, but have less power than the obliques in the first case. In other words, the superior and inferior obliques together contribute more to abduction than the superior and inferior recti to adduction of the globe. This *à priori* is likely if the work done in the two movements be the same, considering that the pure abductor is a smaller muscle acting at less mechanical advantage than the pure adductor.

If we look also at the angles at which the obliques and superior and inferior recti approach the globe, the idea is further supported. In Diagram I (*vide infra*), AB represents the line of the superior and inferior recti making an angle α with the sagittal axis; CD the line of the obliques making an angle β , with the same axis of an emmetropic eye. Berry gives the angle α as 27° , β as 51° ; according to Swanzy, $\alpha = 20^\circ$, $\beta = 55^\circ$; whilst E. Fuchs gives 23° as the measurement of α . The angles support the view that the obliques aid abduction more than the superior and inferior recti aid adduction; they prove nothing, of

course, without an accurate knowledge of the power of the respective muscles and the mechanical advantage as regards distance from the centre of rotation at which they get their attachment to the globe. On the question of relative power for lateral movement, the angles shown in Diagram I are suggestive but not conclusive. I have introduced the diagram with the object of extending its application to myopic and hypermetropic eyes. Let us consider myopia first.

E. Fuchs, in his generally accepted measurements of eyes and their muscular attachments (Von Graefe's Archives, xxx, 4, p. 1), states that in myopia the recti muscles are inserted at distances from the sclerocorneal junction not greater than in the normal eye, and we must assume, therefore, that the elongation of the globe does not affect this part of the eye, although it is enlarged in circumference here; the posterior part of the eyeball is the part where especially the elongation takes place which leads to axial myopia; this results, according to Fuchs, in the oblique muscles being attached at points slightly farther from the posterior pole, though certainly not nearer the centre of lateral rotatory movement, possibly farther from this point. It is well known that myopic eyes are usually prominent; the posterior pole supported on the retro-ocular tissues will be on the same transverse vertical plane as the emmetropic or hypermetropic eye, and the globe in elongating becomes more prominent anteriorly; this will result, I suggest, in the oblique muscles passing more transversely to their insertion and less antero-posteriorly (Diagram II). In other words, the angle β is increased; the angle α is at the same time reduced, for the rectus superior and rectus inferior pass less obliquely forward, having a greater distance in which to arrive at their insertion on the globe whose lateral position with regard to the antero-posterior mid-vertical plane of the orbit is not altered. The increase of the angle β seems to me to accord well with Fuchs's observa-

tion that the line of insertion of the superior oblique (shown by the dotted line in the diagrams) in myopic eyes is almost constantly more antero-posterior than in emmetropic or hypermetropic eyes; it is also usually con-



fined to the postero-external quadrant of the globe, its posterior end terminating on the outer side of the vertical meridian of the globe and not transgressing it as in the type of insertion which he regards as typical of hypermetropic and emmetropic eyes. The result of the alteration in the angles of approach of the tendons would result in the abducting power of the oblique muscles being increased in myopia, while the adducting power of the superior and inferior recti would be diminished. In myopia the balance of power is disturbed in favour of the abductors; slight though the advantage gained may be, the total power required to rotate the globe is very small; parallelism now can only be obtained and maintained by volitional impulses constantly imparted to the adductors, and if the incentive to these be diminished by failure of one eye to contribute a practical share to binocular

vision, the impulses will not be sent to the adductors, the position of rest will be assumed, *i.e.*, a divergent strabismus will result.

In the hypermetropic eye, its posterior pole being on the same plane as that of the myopic or of the normal eye, and the globe being small, the superior and inferior rectus would have to pass outwards more abruptly in their course forwards to their insertion; the obliques will have a slightly longer distance in which to pass back to their insertion, and their direction will therefore be a trifle more antero-posterior and less transverse. In hypermetropia the angle α is increased, and the angle β is diminished (Diagram III). The balance of power is disturbed in favour of the adductors; this, supplemented by the association of convergence with the necessity to use the accommodation, will result in convergent strabismus as the position of rest, and more probably so if one eye be deficient.

When abduction is once started, the obliques are placed in a more favourable and steadily improving position to abduct, while the adduction power of the superior and inferior recti diminishes as the axis of the globe comes to lie nearer and nearer to their own axis; as the globe is adducted, the superior and inferior recti gain in power of contributing to this movement, which the obliques can oppose at less and less advantage.

I would suggest then that we recognise more fully the combined action of every extra-ocular muscle in effecting even the most simple movement. That we cease altogether to speak of insufficiency of the internal recti. As a cause of divergence, let us substitute predominance of the abductors, and distinguish that condition from insufficiency of the adductors, a term which we may employ to denote the inability to maintain active convergence; predominance of the adductors will be a factor in causing concomitant convergent strabismus. In using these terms, let us remember that when one group

of muscles is predominant, the term is a relative one, and implies that at the same time its antagonistic group of muscles is placed at a mechanical disadvantage. Used with this reservation, passive predominance of one group of muscles will tend to a new position of rest, either of convergence or of divergence; the strabismus is the result of the new balance of power which has been struck between the adductors and the abductors.

NOTES ON GLIOMA RETINÆ.

By C. DEVEREUX MARSHALL, *Curator.*

THE cases reported in this paper are those which have occurred at Moorfields since the year 1890, when an article on the subject appeared in the Reports by Messrs. Lawford and Collins, with a record of 60 cases. In addition to those which were actually treated in the hospital, a few cases have also been obtained from private sources, but in all of them the eye containing the growth has been pathologically examined after removal. Mr. Tweedy has sent two eyes from the same patient, while Mr. J. H. Fisher, Assistant Ophthalmic Surgeon of St. Thomas's Hospital, Mr. Rockliffe, of Hull, and Mr. Horsey, of Ottawa, have sent one each.

Several cases have been excluded in which there appeared to be some doubt as to the nature of the growth, and in one or two instances an eye has been received but with insufficient notes to enable one to make use of it for present purposes.

This paper is arranged on lines very similar to the one which preceded it, and, as it has been compiled chiefly as a clinical record rather than as an article dealing with glioma generally, it will be impossible to treat of many of the interesting questions which the study of this disease brings forward.

The chief literature on the subject up till 1890 has been carefully recorded in the previous paper, consequently it will not again be referred to here unless it be required to assist in bringing out any other facts. The whole subject has, moreover, been treated in a most complete manner in a book published this year by Hugo Wintersteiner, "*Das Neuroepithelioma Retinæ.*"

Since 1890 there have been 32 undoubted cases of glioma retinæ, which have been examined in the labora-

tory, and this represents a total of 37 eyes, as there were five cases in which both eyes were removed for growth, either together or after a certain interval of time had elapsed.

Sex.—These cases show that they are distributed fairly equally between the two sexes. Of the 32 cases, 15 were males and 17 females. This shows a slight preponderance of females, but as a rule it is found that in a large number of cases there is but little difference as to the liability of either sex to the disease.

Among 193 cases collected by Lawford and Collins there were 95 males to 78 females, but there were also 20 in which the sex was not mentioned.

Eye Affected.—It is well known clinically how frequently cases of glioma are seen in which both eyes are affected, and it is always of the greatest importance to examine the eye which is apparently sound as well as that which is known to be affected.

In this series both eyes were affected in 12 cases, six of them had the two eyes removed, which were afterwards examined pathologically (Nos. 62, 63, 65, 67,* 71, 92).

The remaining eyes were removed elsewhere in two cases, and consequently were not obtained for further examination (Nos. 61, 70), while in the other four (Nos. 76, 84, 88, 89) the second eye was not removed.

Of the unocular cases, 10 affected the right eye only (Nos. 64, 66, 68, 72, 74, 79, 81, 82, 85, 86). Nine affected the left eye only (Nos. 69, 73, 75, 77, 78, 80, 83, 87, 91), while in one case (No. 90) it is not stated.

Age at which the Growth became apparent.—It is frequently a very difficult question to decide how long a glioma has been present within an eye.

Judging from the number of cases which are seen during the first few months after birth, in which the growth has attained a very large size so as frequently at

* For report of the first eye, see previous paper, Case No. 50.

this early age to entirely fill the eyeball, it is certain that they must really have been present at birth, and had probably been growing during a considerable portion of intrauterine life.

Their presence is, however, not as a rule recognised until they have become sufficiently large to be seen by the mother or nurse through the undilated pupil.

The earliest age at which any of these cases were seen was one month after birth, and this happened in Nos. 79 and 84.*

The total number of eyes which were found to contain gliomata before the children reached the end of the first year of life was 15, and these represented 11 patients. Nos. 61, 76, 79, 83, 84, 87, 92 all had the first eye affected. Nos. 62, 63, 70, 71 had both eyes affected.

Between the ages of one and two years 12 eyes were found to be affected, representing nine patients. Nos. 69, 75, 77, 85 had the first eye affected; Nos. 61 and 76 had the second eye affected; while Nos. 65, 88, 89 had both eyes affected.

Between the ages of two and three years there were eight eyes affected, from eight patients. Nos. 61, 68, 72, 73, 74, 84, 91 all had the first eye affected, while No. 92 had the second eye affected.

Between the ages of three and four years there were four eyes affected from four patients. Nos. 80, 82, and 86, all had the first eye affected, while No. 67 had the second eye affected.

Between the fourth and fifth years there were two eyes affected, from two patients, both of them being the first eye Nos. 64 and 78.

No cases were recorded occurring between the fifth and sixth years.

One patient in this series was 6 years and 10 months old when the eye was first seen to be affected; this was No. 81.

In one case, No. 90, the age is not recorded.

The following is a summary of the ages at which the presence of the tumour was detected.

Before the 1st year.....	15 = 34·89 per cent.
Between the 1st and 2nd years	12 = 27·90 "
" 2nd and 3rd "	8 = 18·60 "
" 3rd and 4th "	4 = 9·30 "
" 4th and 5th "	2 = 4·65 "
" 5th and 6th "	0 = — "
" 6th and 7th "	1 = 2·32 "
Unknown.....	1 = 2·32 "
	43 99·98 "

In only two cases was the growth noticed as early as the first month. In one of them (No. 79) the eye was not removed for over two years; by that time the optic nerve was much involved, and there can be but little doubt that the disease in so advanced a stage ultimately proved fatal, but unfortunately no information could be obtained after the child left the hospital.

In the other case (No. 84) the eye was removed when the child was two months old, and he remained in good health for two years and eight months; he saw well with the other eye, and was bright and intelligent. On examination, however, at this date a large gliomatous tumour was seen at the upper and inner part of the retina. The parents refused to allow the other eye to be removed, but at present sufficient time has not elapsed for the growth to have made any very marked change either in the external appearance of the eye or in the general health of the child. There is no local recurrence in the orbit, nor any evidence of central disease. The growth in the second eye is of course absolutely independent from that of the first.

The table above illustrates the fact that the growths became apparent during the first two years of life in 60 per cent. of these cases, while in about 80 per cent. it appeared during the first three years. It is extremely

uncommon after this. In one case only did it occur as late as the seventh year.

Hirschberg has recorded a case in which the growth was first noticed in a child aged 11 years, but it is excessively rare to find such a development at so late a period.

Recoveries.—A case having been recorded by Vetsch, in which a child died of recurrence three years after the removal of the affected eye, one cannot look upon a patient as being permanently cured until at least this length of time has elapsed, although in by far the majority of cases the growth, unless it has been permanently removed, has reappeared long before this.

There is, however, in this series one case which looks as if this period of time would have to be lengthened; this is No. 69, where the child was first noticed to have an affection of the left eye when 12 months old. The eye was not removed until three years later, when the examination proved that a glioma was present.

The operation was performed in October, 1892, and the patient remained in good health until October, 1897. The child is now very ill, and is said, by the surgeon under whose care he is, to be suffering from "a recurrence of the growth on the brain." This, however, cannot at present be proved.

If, however, we accept the three years' limit as indicating the time after which the patient may be considered safe from recurrence, we find that there are 13 children who are alive and in good health at the present time, and who may be considered cured, and these cases include five in which both eyes have been removed, Nos. 62, 63, 65, 67, 70, and nine in which only one eye was removed, Nos. 64, 66, 68, 72, 73, 74, 75, 81, 82.

Of the remaining cases, six are known to be dead, Nos. 70, 76, 80, 88, 89, 90, while one, No. 61, was suffering from recurrence in the orbit and elsewhere when last heard of, three years ago, and is almost certainly dead by this time, but the parents went to South Africa and cannot be traced,

There are five cases which have not been heard of since they left the hospital, they are Nos. 75, 77, 79, 83, 87. In Case 84, 2 years and 8 months had elapsed without there being any local or general recurrence, but on examination a glioma was found in the other eye. In Case 91 a recurrence was present in the orbit, and the child is probably now dead.

In the remaining three cases, Nos. 85, 86, and 92, sufficient time had not elapsed to say whether they were cured or not, and in Case 92 both eyes had been removed.

The following gives the length of time which has elapsed since the operation in all the cases still alive, and which show no sign of recurrence:—

	No. of case.	No. of years since excision.
Cases which have exceeded the three years' limit.	62	$6\frac{9}{12}$
	63	$6\frac{8}{12}$
	64	$6\frac{6}{12}$
	65	$6\frac{6}{12}$
	66	$6\frac{6}{12}$
	67	6
	68	$5\frac{9}{12}$
	71	$5\frac{1}{12}$
	72	5
	73	$4\frac{2}{12}$
	74	$4\frac{2}{12}$
	78	$3\frac{5}{12}$
	81	$3\frac{4}{12}$
	82	$3\frac{4}{12}$
Cases in which less than three years have elapsed since excision.	85	$2\frac{4}{12}$
	86	$2\frac{1}{12}$
	92	$\frac{7}{12}$ since first eye was removed.

Duration of Life in Fatal Cases.

Six cases are known to have terminated fatally, Nos. 70, 76, 80, 88, 89, 90:—

					Years after excision.
No. 70	terminated fatally	when child was	$2\frac{1}{2}$	this being	$2\frac{2}{12}$
" 76	"	"	$1\frac{4}{12}$	"	$\frac{9}{12}$
" 80	"	"	$4\frac{9}{12}$	"	$\frac{9}{12}$
" 88	"	"	$2\frac{8}{12}$	"	$\frac{2}{12}$
" 89	"	"	2	"	$\frac{8}{12}$
" 90	"	"	$5\frac{8}{12}$	"	$\frac{2}{12}$

Interval of time between Discovery of the Growth and Operation in Fatal Cases and Cases of Recovery.

Of 15 cases which are included in the list of recoveries the average time which elapsed between the discovery of the growth and the excision was 3·06 months, while in four fatal cases the average interval was 4·77 months. The difference of time was much greater in the cases recorded by Lawford and Collins, being in the former 4 months and in the latter 14 months.

Site of Recurrent Growth.

Out of seven cases, of which five were fatal, and two were probably fatal, there was a local recurrence in five (Nos. 70, 80, 88, 90, 91).

In three cases there was recurrence in both orbit and brain (Nos. 70, 88, 91), while in one there was an intracranial growth only (No. 89), and one child was stated, when last heard of, to be suffering from "internal tumours" (No. 61).

On the Shrinking of Eyes which are Affected with Glioma.

Although several cases have been recorded in which a shrunken eye probably contained a glioma, yet in all of them there has been some link wanting in the chain of evidence.

In the paper by Lawford and Collins two cases are recorded in which there is some evidence that the shrinking eyes contained gliomata (Nos. 36 and 58), yet they were not proved.

As in one of the cases here recorded (No. 71) both eyes have been examined microscopically, one of which was much shrunken, it is thought desirable to publish the notes in detail.

Ellen T., æt. 4 months, was admitted under Mr. Couper on November 21, 1892, with the following history:—

"Two weeks ago a white speck was noticed behind the left pupil, but since the child was a month old the eye has been 'turned in.' The child is otherwise healthy, and has had no severe illness. There are two other children, aged respectively 4 and 2 years, and these are quite healthy. There is no history of any hereditary disease, nor of any affection of the nervous system in the family."

On November 22, 1892, the eye was removed. T. normal. At the same time the right pupil was dilated with atropine and the eye thoroughly examined, but no suspicion of a growth was seen.

After hardening in Müller's fluid, the excised eye was bisected and the following condition noted:—

"At the posterior part of the globe, starting from the retina, probably its outer surface, is an oval-shaped mass of a yellowish colour and soft consistency; it comes forwards to about the centre of the vitreous, and is situated over the optic nerve, which, however, appears not to be involved."

One half of the eye was embedded in celloidin, and the following description is given of the microscopic appearance:—

"The growth presents the typical appearance of a glioma retinæ. There are numerous round cells infiltrating the optic nerve up to its point of section; it is difficult to say if these are of inflammatory origin, or if they are really glioma cells."

Six weeks later, January, 1893, the child was again brought to the hospital, and a white gliomatous mass was then seen in the right fundus.

In September, 1894, 1 year and 10 months after the excision, the following note was made:—"Child seen, and is in good health; the right eye is affected, apparently with glioma endophytum; there are floating masses in the vitreous."

In September, 1895, "Nodules of growth and blood vessels are seen immediately behind the lens in the right eye."

In November, 1896, a letter was received from Dr. McFarland, which stated that the child had recently had a feverish attack, with excessive pain in the head. The eye was very much shrunken, but no discharge. The mother states that the general health is now good.

In September, 1897, the child was again seen, and the following note made:—"The right eye is quite blind, irritable, injected, shrunken, and completely atrophied. T. —3. The cornea is hazy, but contains no evidence of having been perforated; there is a small transverse calcareous film across it; nothing deeper is visible."

The eye was removed, and hardened in formol.

On Section.—"The cornea is at least double its proper thickness, and the iris and remains of the lens are in contact with it, thus entirely obliterating the anterior chamber.

"The lens is dislocated slightly downwards, and has for the most part disappeared; the capsule is, however, calcareous, and the space within it contains hardly any of the original lens.

"The vitreous is entirely absent, its place being taken by a solid, whitish growth of a rather dense consistence. The retina is unrecognisable, but the choroid and sclerotic are much thickened."

Microscopic Examination.—"The tumour is a small, round cell growth, containing large vascular spaces. Nearly all the cells stain well, and there is remarkably little degeneration. The ciliary body and the whole of the uveal tract is involved in the growth, the former structure being so much destroyed that it is hardly recognisable, while the choroid is greatly thickened at some places, and much atrophied at others."

"In the vicinity of the choroid numerous pigment cells are seen in the growth, and in places tumour cells are seen invading the choroid secondarily. The optic nerve is extensively involved. In addition to the ordinary glioma cells, there are a large number of others present of a very different appearance. They are much smaller, and they mostly contain two or more nuclei, which stain deeply with hæmatoxylin, while the protoplasm takes up the eosin stain very readily; others show marked signs of degeneration. These cells are scattered all over the section, but at places are collected together in masses by themselves.

"The growth has all the appearance of being a glioma, and the eye has probably become atrophied by the destruction of the ciliary body, and by the extensive involvement of the whole of the uveal tract."

This case is the most complete one with which I am acquainted, and it proves beyond doubt that an eye which contains a glioma may undergo atrophy, leading to shrinking of the whole globe.

There was nothing to lead one to suppose that the eye had ever been perforated. The cornea certainly had not been, and there was no sign of the tumour extending outside the sclerotic, although the optic nerve was much affected.

Family History.

The question as to whether glioma is likely to appear in more than one member of the same family is of the utmost importance to the anxious parents who have, perhaps, lost a child from this dreaded disease.

That such an occurrence must be very uncommon, at least in England, is proved by the remarks in the previous paper by Lawford and Collins, where it is stated, "we have found no instance in which more than one member of the family has suffered from glioma of the retina."

Fuchs* records a case in which a child, æt. 4 years, was brought to him suffering from a glioma of the right eye, which had already perforated the sclerotic. The entire orbital contents were removed, but the child died six months later, with brain symptoms and a local recurrence.

Some months later a brother of the last patient was brought, who was 2 years old, and whose right eye had been blind since birth, although it had only recently become enlarged. This child likewise had glioma, and died of a recurrence about a year after removal of the eye and tumour.

Soon afterwards the mother brought her last child,

* Text-book of Ophthalmology, p. 418.

then only a few months old, because she had noticed a peculiar appearance in the left eye.

This child, however, did not have a glioma, but a typical coloboma of the iris and choroid. The family history here is taken to indicate that "a congenital morbid disposition very often lies at the bottom of glioma."

One of the cases (No. 89) has a most interesting family history, and as such a case has not previously come under observation, the full details will be given.

CASE 89.—Ada Lydia W——, æt. 2 years, was admitted under Mr. Lang on July 16, 1896, with the history that for about two months a whitish appearance had been seen in the right eye. Glioma was diagnosed, and the eye was excised. On examination under chloroform a glioma was also seen in the left eye. Consent for the removal of this, however, could not be obtained. She was not again seen, and for about seven or eight months she remained fairly well, but at the end of that time she suddenly died in convulsions. The parents, who were most illiterate, did not notice any change in the remaining eye.

The history of this family, although perhaps a little incomplete in detail, is extremely interesting.

The first child the parents had was a girl, born in 1879. When about 2 years of age a white mass was seen inside the eye, and she was seen at more than one London hospital, but still no operation was performed. She became worse, until at last the eye burst, and she died in convulsions, æt. $3\frac{1}{2}$ years.

The second child was a boy, whose eyes were not known to be affected, but he died in convulsions, æt. 3 months.

The third child was a boy, who at the present time is 15 years of age. The right eye became first affected when he was about 9 months old; it was similar in appearance to that of the first child. He was taken to Guy's Hospital, where the eye was removed. He now has good sight in the remaining eye, and is in excellent health.

The fourth child is a girl, æt. 9 years, who has no eye affection, and is in good health.

The fifth child is 7 years of age, and is also in good health, with no eye affection.

The sixth child is the patient who undoubtedly had glioma, which directly or indirectly proved fatal.

There is nothing of note in the history of the father's or mother's family, and there is no consanguinity.

In the face of the numerous cases in which only one member of the same family is affected with glioma, we must conclude that such a remarkable fact that three members of one family have probably suffered from the disease is a thing of very great rarity, but still the fact that such a thing may occur should make us very guarded in giving a prognosis with regard to other children which the parents may possibly have.

Undoubtedly the correct thing to do would be to examine at intervals these children, so that the presence of a glioma should be detected at the earliest possible period, as it is a fact which is proved beyond all question that the sooner an eye affected in this way is removed the better will be the chance of the life of the patient.

There is one other fact which appears by some to be hardly realised, viz., that however completely the growth may have been removed, and no matter how healthy the optic nerve is at the point of section, yet the factor which determined the growth of a glioma in one eye may still be present in the other in a latent form, and in such a case it would be impossible, or at any rate most unwise, to state that the child was free from all source of disease until such time has elapsed beyond which glioma has never been known to appear. Case 84 is an example of a child remaining to all appearance quite healthy for a period of two years and ten months after an eye containing the growth had been removed. The parents noticed nothing wrong with the child nor with the sight, and the mother brought him to be examined only because she had received a letter requesting her to do so. She came expecting to be told that nothing was the matter, but on examining the patient a fairly large glioma was seen to be

present at the upper and outer part of the eye, and being out of the direct line of vision it was unnoticed. Indeed, such cases are by no means rare.

A case has recently been observed which leads one to impress strongly the fact that it is impossible to give too guarded a prognosis in cases of this disease, the origin of which is so obscure, and although everything points to the fact that the tumour has not exceeded its ocular bounds, one should not state that the disease is entirely eradicated by the operation; time only can prove this.

CASES OF GLIOMA RETINÆ.

No. of case and Register No.	Name, Surgeon, and date.	Eye affected.	Age when growth was first noticed.	Age at date of operation.	Date of 1st symptom of recurrence.	Duration of life after operation.
61 3309	Violet Morris A. Q. S. 19.1.91	L.	$\frac{8}{1\frac{1}{2}}$	$\frac{10}{1\frac{1}{2}}$	..	..
62 3345	Hilda Leverett W. L. 2.3.91	L.	$\frac{1\frac{1}{2}}{1\frac{1}{2}}$	$\frac{10}{1\frac{1}{2}}$	..	Alive ..
" 3365	" 17.3.91	R.	$\frac{10}{1\frac{1}{2}}$	2	..	" ..
63 3369	William Holyoak G. L. 20.3.91	R.	$\frac{6}{1\frac{1}{2}}$	$\frac{7}{1\frac{1}{2}}$	..	" ..
" 3369	" G. L. 20.3.91	L.	$\frac{6}{1\frac{1}{2}}$	$\frac{7}{1\frac{1}{2}}$	..	" ..
64 3418	Helen Holbrow J. C. 2.6.91	R.	4	4	..	" ..

Great suffering may be caused to a family, and severe criticism may be incurred by the surgeon should a child ultimately suffer from a local or general recurrence, or should an independent tumour start in the remaining eye, after a positive assurance has been given that the patient is completely cured.

In conclusion, I have to thank Dr. Gordon Byers, the Junior House Surgeon at Moorfields, for his assistance in helping me to trace the cases which have formed the basis of this paper.

CASES OF GLIOMA RETINÆ.

Position and extent of primary growth.	Tension.	Site of recurrence.	Family history.	Remarks.
Globe about $\frac{2}{3}$ rds full of growth, which arises from outer surface of retina	..	"Internal tumours"	Negative	R. eye excised in 1892 elsewhere for glioma. She then had recurrence in orbit, and is almost certainly dead now. Cannot be traced.
$\frac{5}{8}$ ths of globe filled with soft growth from outer surface of retina	T. n.	None		In excellent health, September, 1897.
Nodulated growth springing from outer surface of retina	T. n.	"	"	" " "
Glioma endophytum. Retina extensively involved. Vitreous cavity almost full	..	"	"	October, 1897, alive, but an idiot.
Glioma exophytum half filling globe	..	"	"	" " "
Glioma endophytum. Retina extensively involved	T. +	"	"	In good health, November, 1897.

CASES OF GLIOMA RETINÆ.

No. of case and Register No.	Name, Surgeon, and date.	Eye affected.	Age when growth was first noticed.	Age at date of operation.	Date of 1st symptom of recurrence.	Duration of life after operation.
65 3420	Victor Allen W. L. 4.6.91	R.	1	$1\frac{8}{12}$	..	..
	"	L.	"	"	..	..
66 3421	Walter Sear A. S. M. 5.6.91	R.	$2\frac{1}{12}$	3	..	..
67 3601	Sidney Rabbitt E. N. 20.1.92	L.	$3\frac{4}{12}$	$3\frac{5}{12}$	..	..
68 3651	Minnie Solomons E. N. 12.3.92	R.	$2\frac{3}{12}$	$2\frac{6}{12}$	..	Alive ..
69 3825	Sidney Richardson W. L. 10.10.92	L.	1	4	..	" ..
70 3834	John Keeble J. T. 25.10.92	L.	$1\frac{4}{12}$	$\frac{8}{12}$	Unknown ..	$2\frac{2}{12}$
71 3362	Ellen True J. C. and E. T. C. 22.11.92	L.	$1\frac{3}{12}$	$1\frac{4}{12}$	..	Alive ..
	"	R.	$1\frac{5}{12}$	5	..	"
72 3898	Annie Cope A. S. M. 13.1.93	R.	$2\frac{1}{12}$	$2\frac{3}{12}$	..	" ..

CASES OF GLIOMA RETINÆ.

Position and extent of primary growth.	Tension.	Site of recurrence.	Family history.	Remarks.
Glioma exophytum. Whole retina involved and detached	T. full	None	Negative	November, 1897, in good health. No sign of recurrence.
Shrunk globe containing a glioma	Shrunk	"	"	" " "
Growth from outer surface of retina. Numerous nodular masses	T. + 1	"	"	October, 1897, alive and in good health. <i>17.2.05 alive, well.</i>
Growth from inner surface of retina not involving O. D.	T. n.	"	"	The R. eye was removed January, 1889. Case No. 50 in previous paper by Lawford and Collins. In October, 1897, the child is alive and in excellent health.
Flocculent growth from inner surface of retina. O. N. unaffected	T. n.	"	"	September, 1897, alive and well. <i>14.2.05 alive well.</i>
Growth from outer surface of detached retina. O. N. invaded, but not so far back as section	T. +	"	Not known ..	November, 1897, extremely ill, is delirious, and has convulsions. <i>14.2.05. alive well.</i>
Growth from outer surface of retina	..	Intracranial and right orbit	Several children of parents have died from "consumption of the bowels."	R. eye seen to be affected at time left was removed. The right eye was removed elsewhere one month before child died.
Soft growth filling half the vitreous growing from outer surface of retina. O. N. invaded by round cells. P growth	..	None	Negative.	<i>Jan. 02 alive.</i>
Globe half full of growth from outer surface of retina. O. N. involved, but not so far back as section	..	None	"	September, 1897, patient in excellent health, with no sign of recurrence. <i>17.2.05 alive well</i>

CASES OF GLIOMA RETINÆ.

No. of case and Register No.	Name, Surgeon, and date.	Eye affected.	Age when growth was first noticed.	Age at date of operation.	Date of 1st symptom of recurrence.	Duration of life after operation.
73 4001	William Scannell A. Q. S. 4.5.93	L.	$2\frac{1}{2}$	3	..	Alive ..
74 4111	Harry Chattaway W. T. 5.10.93	R.	2	$2\frac{6}{12}$	..	„ ..
75 4120	Florence Best A. S. M. 10.10.93	L.	1	$1\frac{9}{12}$	..	Unknown ..
76 4124	Louisa Kablean W. T. 16.10.93	L.	$\frac{6}{12}$	$\frac{7}{12}$	Unknown ..	$\frac{9}{12}$
77 4236	Mabel Bridle J. B. L. Case from St. Thomas's Hospital 11.5.94	L.	1	2	..	Unknown ..
78 4362	George Sargent A. S. M. 13.7.94	L.	4	4	None ..	Alive ..
79 4372	Arthur Sims J. T. 17.7.94	R.	$\frac{1}{12}$	$2\frac{3}{12}$	..	Unknown ..
80 4381	James Armstrong Mr. Horsey's case 18.4.94	L.	$3\frac{6}{12}$	4	4 months after opera- tion.	$\frac{9}{12}$
81 4393	Gilbert White J. B. L. 8.8.94	R.	$6\frac{1}{12}$	7	..	Alive ..
82 4399	Helen Warner J. T. 17.8.94	R.	3	3	..	„ ..

CASES OF GLIOMA RETINÆ.

Position and extent of primary growth.	Tension.	Site of recurrence.	Family history.	Remarks.
Whole inner surface of retina involved and detached. O. N. not involved	T. full	None	Negative	September, 1897, in excellent health.
Both surfaces of retina involved in a gliomatous growth	T. n.	„	„	September, 1897, in excellent health. A. D. 1897. 1897.
Large growth from inner surface of retina	..	Unknown ..	Only child ..	Patient has not been heard of since leaving hospital.
Flocculent growth from outer surface of retina, nearly filling globe	T. n.	„	8th month child..	Two months before death other eye was found to contain a growth; a month later recurrence in L. orbit, numerous lumps at back of head. Child died in a fit.
Vitreous chamber filled with new growth	T. n.	..	1st child	
Large growth springing from detached retina	T. n.	Unknown ..	Negative	November, 1897, in good health. R. eye healthy. No recurrence. A. D. 1897. 1897.
Flocculent growth from inner surface of retina; optic nerve much involved	T. n.	..	„	Not heard of since operation.
Globe nearly full of growth; O. N. extensively involved	T. + 2	Orbit	Negative. 5th child. All the others healthy.	
Small growth from outer surface of retina, which is completely detached; O. N. not affected	T. n.	None	..	November, 1897, child is now in good health, but has had an attack of interstitial keratitis in left eye.
Vitreous chamber almost full of growth; O. N. much involved	T. + 1	„	..	September, 1897, in good health. No recurrence.

CASES OF GLIOMA RETINÆ.

No. of case and Register No.	Name, Surgeon, and date.	Eye affected.	Age when growth was first noticed.	Age at date of operation.	Date of 1st symptom of recurrence.	Duration of life after operation.
83 4495	Bertie Aylen R. M. G. 19.12.94	L.	$\frac{3}{1\frac{1}{2}}$	5	..	Unknown .
84 4528	Sidney Everist E. N. 9.2.95	L.	$\frac{1}{1\frac{1}{2}}$	$\frac{2}{1\frac{1}{2}}$	..	Alive ..
85 4672	Leonard Carter A. Q. S. 12.8.95	R.	$1\frac{3}{1\frac{1}{2}}$	$1\frac{4}{1\frac{1}{2}}$	..	„ ..
86 4757	Elsie Burdett J. B. L. 27.11.95	R.	3	3	..	„ ..
87 4827	James Rooke J. B. L. 12.2.96	L.	$\frac{5}{1\frac{1}{2}}$	$\frac{6}{1\frac{1}{2}}$	..	Unknown ..
88 4848	Nellie Norfolk E. N. 11.3.96	L.	$1\frac{10}{1\frac{1}{2}}$	$2\frac{6}{1\frac{1}{2}}$	Growth present in orbit when eye was excised	$\frac{2}{1\frac{1}{2}}$
89 4959	Ada Wright W. L. 16.7.96	R.	$1\frac{10}{1\frac{1}{2}}$	2	..	$\frac{8}{1\frac{1}{2}}$

CASES OF GLIOMA RETINÆ.

Position and extent of primary growth.	Tension.	Site of recurrence.	Family history.	Remarks.
Vitreous $\frac{2}{3}$ rds full of growth	T. + 2	None	..	Not heard of since operation. <i>by 20.2.05. alive well.</i>
Vitreous nearly half full of growth, and almost entirely detached	T. n.	R. eye affected with glioma	<i>Died .. April 26 00</i>	October, 1897, child in good health, but a glioma seen to be present in R. eye.
$\frac{1}{4}$ ths of globe full of growth; retina completely detached	T. +	None	..	October, 1897, child in excellent health. L. eye healthy.
Growth springs from outer surface of retina; it about half fills globe	T. +	..	Negative	December, 1897, in good health; no recurrence. L. eye healthy.
Large white tumour growing from retina, which is quite detached	T. n.	..	..	<i>20.2.05. alive well. L. Normal. S. Normal.</i> Not heard of since operation.
Glioma completely filling eyeball and part of orbit at the back	..	Local, and probably in brain	Specific history	R. eye blind before death. Glioma seen at time of operation.
Large growth from choroidal surface of retina	T. n.	Probably in brain	First child, a girl, died in convulsions, æt. $3\frac{1}{2}$; white mass seen in eye. It was not removed Second child, a boy, died in convulsions, æt. 3 months. No known eye affection. Third child now æt. 15. R. eye removed for glioma when 10 months old. Nov. (1897) in good health. Fourth and fifth children, æt. 9 & 7, in good health. Sixth child is the patient. No specific history and no consanguinity.	Child died in convulsions. Glioma seen in left eye at time that R. was excised.

CASES OF GLIOMA RETINÆ.

No. of case and Register No.	Name, Surgeon, and date.	Eye affected.	Age when growth was first noticed.	Age at date of operation.	Date of 1st symptom of recurrence.	Duration of life after operation.
90 96 O.P.	Dorothy Forward Mr. Rockliffe's case 27.3.96	..	..	$5\frac{6}{12}$	$\frac{1}{12}$ after operation	$\frac{2}{12}$
91 114 O.P.	Primrose Wallace 17.6.96 Mr. J. H. Fisher's case	L.	$2\frac{4}{12}$	$2\frac{6}{12}$	..	..
92 170 O.P.	Mr. Tweedy's case Female 27.5.97	L.	$\frac{3}{12}$	$1\frac{10}{12}$	..	..
" 190 O.P.	Same case 29.9.97	R.	$2\frac{1}{12}$	$2\frac{2}{12}$	..	..

CASES OF GLIOMA RETINÆ.

Position and extent of primary growth.	Tension.	Site of recurrence.	Family history.	Remarks.
Globe nearly full of growth, with a large mass projecting into orbit	..	Orbit and probably brain	..	Child died suffering from sickness, headache, constipation, and growth in orbit. No P.M. allowed.
Globe nearly half full of a dense flocculent growth	T. +	Orbit.		
Globe nearly full of a gliomatous growth. Head of O.N. involved, but section seems to be free				
Gliomatous mass filling nearly two-thirds of globe.				

THE OPERATIVE TREATMENT OF LAMELLAR CATARACT.

By E. C. FISCHER, late Senior House Surgeon, and
C. DEVEREUX MARSHALL, Curator.

THIS is a subject which has not for many years been investigated at Moorfields, and as the methods of operating have improved, it seemed to us that some interesting observations were to be made by examining a considerable number of cases.

Many surgeons of large experience publish their results of the treatment of senile cataract, and a report of 1,509 cases, which represented the operations done at Moorfields during five years, 1889—1893, was published in Vol. xiv, Pt. I, of these reports by one of us (C. D. M.).

By referring to this paper a certain comparison may be drawn between the operations for cataract which are performed upon individuals who are not far removed from the two extremes of life.

We may classify the operations done for lamellar cataracts into the following groups:—

1. { (a) Simple needling.
(b) Needling followed by curette evacuation.
(c) Needling followed by suction.
2. (d) Extraction.

It would be extremely interesting to compare these four operations side by side, but there is an insurmountable difficulty in doing so, and we find that for practical purposes we can only divide the operations into two groups. The first includes needling either alone or followed by evacuation, and the second includes those cases in which the lens is removed as completely as possible, as in the case of senile cataract, without a previous needling.

The reason for this is obvious. All the cases in the

first group have to run the risks which attend needling, and whatever is done subsequently cannot prevent these. Indeed, many surgeons are by no means anxious to undertake a second operation on the eye of a child when the lens is undergoing gradual, if not rapid, absorption while the eye remains quiet and free from injection, even should the time be prolonged before the pupil becomes clear enough to render good vision possible by the aid of glasses. No operation can be regarded as absolutely free from danger, and it is often considered an unnecessary risk to run to undertake some further procedure when there is no urgent need for it. In these cases especially there is no great hurry. The patients as a rule are quite young; they frequently have sufficient vision with the other eye to meet their requirements, while a few months one way or the other makes not the least difference to them, a final good result being the one thing to be aimed at. Everyone, of course, is agreed that should there be anything like undue swelling of the lens leading to tension, or even to irritation which may produce tension, it is wise to evacuate the lens matter before this complication actually occurs; in other words, no good can possibly result by waiting till all the symptoms of acute glaucoma are present before giving relief by a further operation; but should the patient be under observation one may safely allow the broken-up lens matter to gradually absorb, if it will do so without causing either pain or irritation.

That a simple needling operation on any eye is unattended by danger is a statement that can by no means be proved, and clinical experience is at direct variance to any such idea.

In the paper previously referred to it was found that the percentage of suppuration was nearly as great after needling of capsule as after extraction, being 1.02 per cent. in the former and 1.72 per cent. in the latter, while the percentage of cases in which glaucomatous symptoms

set in was much greater, being 2·08 per cent. after needling and 0·53 per cent. after extractions of all sorts.

Now, it becomes obvious that if after a needling operation the eye escapes these two dangers, it has gone a long way on the right road towards having an ultimately successful result whatever else is done, and therefore we cannot possibly compare the results of the several operations included in the first group.

The cases, however, which have had a primary extraction may be compared, as they have never undergone a needling operation at all.

In the cases which form the basis of this paper there were 260 which were needled, or needled and evacuated, the exact numbers being:—

Simple needlings	123
Needling, followed by curette evacuation..	113
Needling, followed by suction	24
	260

Of the simple needlings, eight eyes suppurated and five were excised. Of the needlings followed by curette evacuation, one eye was excised for slow suppurative iritis one month after the primary operation. Of the needlings followed by suction, one eye suppurated and was excised. This gives a total of 10 lost eyes in 260 cases, or a percentage of 3·84. Thus it is seen that needling in these cases yields a larger percentage of suppurations than needling after cataract extractions, which, as has previously been shown, equalled 1·02. It is well known that cases in which suction is performed are more liable to suppurate than when only a curette is used; but the operation of suction is now but seldom done unless there is any great difficulty in removing the lens, and obviously the more instrumentation that is resorted to, the greater will be the risk of some complication happening. Suction is never needed if the lens is

well broken up and disintegrated, as the result of the previous needling, for in such a case it would readily come away without such a powerful apparatus as a suction syringe; but, if it be not well disintegrated, it is better to leave it where it is rather than to use any forcible means for its evacuation.

The cases which were extracted without a previous needling are so few in number that it is hardly fair to make a comparison. There are six of these, however, the notes of which are appended, so that the general course which such cases run may be readily seen.

Case 1 was re-admitted with severe iritis.

Case 3 suffered from prolapse of iris, severe iridocyclitis, shrinking of the globe, and finally the eye was removed two months later.

Cases 2, 4, and 5 did well.

Case 6 also finally did well, though it caused much trouble before it quieted down.

If we take it that an eye was lost out of six, it gives the enormous percentage of 16·66, though the cases are far too few for this really to represent fairly the result. However, the operation is not one to be recommended in preference to the more usual methods.

Appended is a short abstract of the notes of these six cases.

Lamellar Cataract Extraction.

CASE 1.—Girl, æt. 12. Dense lamellar opacity.

L. Extraction with Iridectomy. No complication at operation, except owing to sticky nature of lens. Subsequently inner angle of iris became drawn up to wound, and eye became considerably inflamed. Discharged from hospital 14 days after operation, but returned in another fortnight with severe iritis, for treatment of which patient was re-admitted to the hospital.

CASE 2.—Girl, æt. 9.

L. Extraction with Iridectomy. Uncomplicated; lens very sticky, and some cortex left behind. Eye did not resent operation.

CASE 3.—Boy, æt. 9. Not very dense cataract.

L. Extraction without Iridectomy. Vitreous presented almost immediately, and a small portion was lost; lens nucleus alone appeared to come away. Subsequently the iris became prolapsed in scar, and severe irido-cyclitis with much keratitis punctata followed. Finally globe began to shrink, and eye was excised two months after operation.

CASE 4.—Girl, æt. 14. Very dense lamellar opacity.

R. Extraction with Iridectomy. No complications. Eye did quite well, and V. subsequently 6/12, and J. 1, with correction.

CASE 5.—Girl, æt. 6. Lamellar cataract, with history of increase of the opacity during last two years.

R. Extraction with Iridectomy. Peripheral section of capsule. Opacity at anterior pole did not come away with lens. Eye did quite well.

CASE 6.—Boy, æt. 7. Dense lamellar cataract.

R. Extraction without Iridectomy. Lens delivered through wide corneal incision. It was very sticky, and was removed in bits after much difficulty. Four days later eye became very irritable, due to some lens and capsule entangled in corneal wound. T. —. The wound was consequently re-opened and some capsule withdrawn; vitreous presented. A few days later a strand of capsule attached to corneal wound was divided. Eye subsequently quieted down.

This investigation being undertaken from a purely clinical standpoint, it would be out of place to speculate as to the cause of the suppuration and other complications which unfortunately occur; suffice it to say, however, that in all cases the greatest care is taken to prevent infection by means of the instruments which are used: they are all boiled, soaked in 1—20 carbolic, and are taken from a bath of 1—40 by the surgeon immediately before use.

In summarising the results of this important class of case it is obvious that we cannot always be certain of getting a good result, the danger of complications arising

AN HISTORICAL REVIEW AND CRITICISM OF THE BACTERIOLOGICAL HISTORY OF TRACHOMA, WITH PERSONAL OBSERVATIONS ON FIFTEEN CASES.

By ARNOLD LAWSON, F.R.C.S. (Eng.).

THERE is probably no disease which has given rise to so much discussion amongst those who are interested in the bacteriology of the eye as trachoma. The specific origin of this disease has been the subject of numerous papers from the pens of Continental and American observers, but English ophthalmologists have, up to the present time, contributed very little to the literature of this affection; probably because the disease does not hold the same prominent position in this country as in many others.

I have therefore thought that it might be of interest to give a short historical review of the published researches into the bacteriology of this disease before proceeding to any personal observations of my own upon the matter.

The first published observations on the microbial origin of trachoma came from Hirschberg and Krause (*Centralblatt f. prakt. Augenheilk.*) in the year 1881. These authors announced that they had discovered club-shaped micro-organisms in the secretion obtained during the acute stages of trachoma, but had failed to find them in the chronic stages of the disease. During the same year Sattler read his first paper on the subject before the Congress at Heidelberg, when he stated that he had isolated a special micrococcus from the lids of patients affected with trachoma. These micrococci were circular in shape and most usually united in series of threes or fours, but never appeared in chains as *Streptococci*, nor in large masses as *Staphylococci*. They were also motile. With inoculations of pure cultures of this micrococcus, Sattler claimed to have succeeded in producing trachoma

in man, but had failed in all attempts to transmit the disease to animals.

In 1882 Sattler read a second paper on the subject before the Ophthalmological Society of Heidelberg. He had made further extended researches, and described a case in which he said he had successfully produced trachoma by inoculating a culture of his micrococcus into the conjunctiva of a little girl. No histological examination had, however, been made of the patient's conjunctiva, so that positive proof of his success was lacking.

Two years later, 1884, found Koch in Egypt studying the origin of cholera, and whilst thus engaged he also undertook some researches into the origin of Egyptian ophthalmia. He found many varieties of micro-organisms, and isolated, amongst others, a bacillus analogous with that of mouse septicæmia. This bacillus is apparently identical with that described later by Kartulis and Weeks, and known now as the Koch-Weeks bacillus. This bacillus is now generally believed to be the specific organism in "pink eye," or acute catarrhal conjunctivitis.

In 1885 Raehlmann, in a treatise on trachoma (Samml. Klinisch. Vort. herans v. Volk, Leipzig, 1885), announced that he had isolated small round micrococci, and Poncet (Gaz. des Hôp., 1886) in the following year also succeeded in isolating a definite micrococcus.

During this year (1886) Michel published in the *Archiv f. Augenheilkunde* the results of his extensive researches as to the specific origin of Egyptian ophthalmia. Michel's conclusions may be shortly summarised as follows:—

(1) The definite specific micro-organism of trachoma is a micrococcus which should be sought for in the trachoma follicles themselves, and not in the conjunctival secretions.

(2) Morphologically this micrococcus, which he styles the trachoma coccus, is a diplococcus, very small in size and biscuit-shaped. The dividing line is very narrow.

(3) Biologically it is non-motile, but exhibits marked rotatory and oscillatory vibrations. It is strictly aerobic. It grows slowly and scantily on nutrient gelatin which is *non-liquefied*. On agar-agar and blood-serum at blood heat the growth is rapid and abundant, and spreads out like a white cloud. In consistence it is viscid, adhering to the platinum needle. On potato the growth is very scanty.

(4) True trachoma is induced by the inoculation of pure cultures of this micro-organism into the human conjunctiva.

Logetchnikow (Trav. de la Soc. Phys. Méd. de Moscou, 1886) has endeavoured to discredit these researches of Michel by stating that the latter mistook an epidemic of follicular conjunctivitis for true trachoma.

In 1887 Koucherski (Centr. f. prakt. Augenh., 1887) published the result of his labours. He made separate examinations of the conjunctival discharge and of the trachomatous follicles. In the former he encountered varieties of micrococci and bacilli either associated together or as pure growths. In the trachomatous follicles he discovered small diplococci, which he styled "trachoma cocci." These cocci liquefied gelatin, and microscopically resembled the gonococci of Neisser. The author inoculated various animals, rabbits, pigeons, dogs, cats, &c., with pure cultures of the organism, but met with no success, and was equally unsuccessful in five cases where he endeavoured to induce trachoma in man.

The next article on the subject was a thesis written by Schmidt for his degree of Doctor of Medicine. The writer drew distinction between the coccus described by Sattler and that described by Michel, giving it as his opinion that Michel's coccus was the microbe of acute blenorrhoea, or of trachoma complicated by acute blenorrhoea. He himself had isolated a micrococcus much resembling the *Staphylococcus pyogenes*, but larger, less motile, and liquefying gelatin less quickly. This coccus appeared to

be identical with that described by Sattler. He further claimed to have succeeded in inducing trachoma in birds and animals, although repeated inoculations were required in the case of mammals before he met with success.

In 1888 Staderini (*Ann. d'Ocul.*, xcix) succeeded in isolating a diplococcus resembling the gonococcus, but smaller. He inoculated the micro-organism into animals which were kept in unsuitable and unhealthy surroundings, with a view to form a predisposition to disease. He came to the following conclusions:—Inoculations of the diplococcus into the conjunctival sacs of rabbits gave rise to a trachomatous conjunctivitis in those animals which were badly nourished and crowded together, whilst the result was negative in those rabbits that were well fed and had plenty of air space. The author went on to say that the follicles of trachoma were due to the irritation set up by micro-organisms, the process being accompanied by an exudation of leucocytes.

The above paper was followed shortly afterwards by an article by Petresco, of Bucharest (*Ann. d'Ocul.*, xcix), in which the author stated that besides many varieties of cocci and bacilli, he had isolated a special micrococcus, to the presence of which he attached considerable importance. This micrococcus differed from Michel's coccus in the fact that it liquefied gelatin. It could be distinguished from the gonococcus of Neisser by staining well by Gram's method, and from the coccus described by Poncet in 1886 in being found in the trachomatous follicles and not only in the conjunctival discharge. All the author's efforts, however, to induce trachoma in animals were unsuccessful.

During the next year (1889) Reid, in a paper read before the Ophthalmological Society of the United Kingdom, declared his inability to find any special micro-organisms whatever in trachoma.

In 1890 the question of the origin of trachoma was discussed at the Ophthalmological Section of the Interna-

tional Medical Congress held at Berlin. MM. Raehlmann, Schmidt-Rempier, Swaen-Burdet, Sattler, and Chibret took part in the discussion, and whilst all these authorities were unanimous in recognising an undoubted infective process in trachoma, not one investigator could secure universal approval for the specific nature of any one particular microbe. During this same year Shongolowitch wrote a thesis on the subject for his degree of Doctor of Medicine. He stated that he had succeeded in inducing a granular conjunctivitis in rabbits and cats by inoculations of pure cultures of a particular bacillus which he had succeeded in isolating from the contents of trachomatous follicles. The bacillus was characterised by its small size, its slenderness, and by its imperviousness to ordinary stains.

A fresh impetus to the question was given next year, 1891, by an article by Noisewski (*Archiv f. Augenh.*, 1891), who brought forward an entirely new specific agent for trachoma in the shape of a bacterium closely allied to the "microsporon furfur of Kaposi." To this he gave the name of the "microsporon trachomatosam."

Noisewski absolutely denied the specific nature of any of the micro-organisms described by other writers, and declared that true trachoma had resulted in four or five weeks after inoculation of his "microsporon trachomatosam" into the conjunctival sacs of rabbits.

In the latter half of the same year a paper appeared in the *Ophthalmic Record* in which the author, Fulton, expresses his belief in the specific nature of Michel's micrococcus.

The advancement of all these varied organisms, to each of which a specific nature had been so readily ascribed by its enthusiastic discoverer, naturally enough led to a reaction in thought, and Mutermilch, in 1893 (*Ann. d'Ocul.*, cix), wrote a paper on "The Nature of Trachoma," the sum of which amounted to a total denial of the contagious character of acute trachoma.

He was followed by Guénod (*Gaz. des Hôpitaux*, 1894), who expressed great doubt as to the existence of a special micro-organism in trachoma. "Although," he says, "the contagious character of the granulations is supported by weighty arguments, one cannot help thinking that trachoma, having regard to the strict localisation of the disease in lymphoid tissue, has an endogenous origin."

Fuchs now enters into the controversy, and during this same year (1894) he published his opinion on the subject in his *Text-book on Ophthalmology*. It may be summarised as follows:—The ultimate origin of the disease is probably the gonococcus. The gonococcus transferred to the conjunctiva causes an acute gonorrhœal ophthalmia, and when this becomes chronic a similar transference of the infective material gives rise to trachoma.

This opinion of the gonorrhœal origin of trachoma is shared by Hoor, who wrote a paper to this effect during the following year (1895).

A strong supporter of Mutermilch's views came forward this year (1895) in the person of Gunning (*Gennesk Tydssler*, 1895). This author expresses his disbelief in the contagiousness of trachoma. He says that there is no mucous or purulent secretion peculiar to trachoma; the presence of such secretion indicating the presence of complications either of acute catarrhal or of purulent conjunctivitis. The proofs of the non-contagiousness of trachoma lie (1) in the fact that it is frequently confined to one eye, and (2) that the inoculation of the discharge from trachomatous eyes produces only a catarrhal inflammation, and not trachoma.

On the other hand, Van Millingen (*Ann. d'Ocul.*, cxiv, 1895) published about the same time the results of exclusive researches that he has made on the subject, and he is strongly of opinion that trachoma is both infectious and contagious.

Lastly, in the following year (1896) an admirable thesis, written by Cazalis for his "Doctorat" at the Uni-

versity of Montpellier, brings us to the most recent extended investigations on the subject. To this thesis—which is not in general circulation, and so not easily obtainable—I am indebted for much valuable information in compiling this short historical review. It will be interesting to give a few notes on the results of Cazalis' work.

Cazalis isolated from cases of trachoma three varieties of bacilli :—

- (1) Koch-Weeks' bacillus.
- (2) Club-shaped bacillus, frequently found associated with the Koch-Weeks' bacillus, and probably identical with the pseudo-diphtheritic bacillus.
- (3) A bacillus characterised by bi-polar staining and by being decolorised by Gram's method.

Inoculations of pure cultures of bacilli (Nos. 2 and 3) into the conjunctival sacs of animals set up a muco-purulent conjunctivitis with severe reaction and accompanied by temporary enlargement of the conjunctival follicles.

Cazalis further isolated and experimented with a streptothrix (*Streptothrix Færsterii*) which he encountered associated with a micrococcus, but he met with no positive results.

As regards micrococci, Cazalis isolated the gonococcus in one case, and frequently found staphylococci and streptococci. He also succeeded in obtaining pure cultures of the Sattler-Michel micrococcus in two cases. This latter micrococcus he found in the conjunctival secretions, on the surface of the conjunctiva, and in the substance of the trachomatous follicles. He experimented with this micro-organism on animals, but in all cases his results were negative.

Cazalis concludes his personal observations by confessing his inability to assign a specific nature to any particular micro-organism.

Since Cazalis' paper, Unthoff has published, during the last months of 1897, a monograph upon the bacteriology

of conjunctivitis, and in speaking of trachoma, he expresses his firm belief in the existence of some special specific organism which at present is unknown.

Observations on Personal Researches.

The subjoined notes relate the results of the bacteriological examination of 15 cases of acute trachoma. They are simply intended as a preliminary record of an investigation into the subject upon which I have been engaged for some time past at the British Institute of Preventive Medicine, and do not pretend to any authoritative or dogmatic statements. I venture to relate them as a personal addition to this short paper. I take this opportunity to tender my best thanks to the Institution of Preventive Medicine for the great facilities offered me, and to Dr. Allan Macfadyen and Dr. W. Hewlett, the director and assistant bacteriologist, for their most kind and able assistance.

I primarily undertook this investigation to endeavour to find out in what percentage of cases of acute trachoma the Sattler-Michel micrococcus would be found; and for this purpose I determined to compare cases of Egyptian trachoma with cases met with in this country. Whilst engaged on this I also paid attention to any other organisms encountered.

Mr. Kenneth Scott, of Cairo, most kindly sent me over from Egypt 12 agar-agar tubes, inoculated with the follicles of 12 cases of Egyptian trachoma, upon which he had operated by expression of the follicles. The trachomatous follicles were rubbed on to agar-agar tubes, and then immediately despatched to England, where they arrived about a week later. A series of agar-agar plates was made from the tube on arrival, and the various colonies examined and transferred on to other media. Three of the tubes were spoilt on transmission, so that I have only records of nine out of the 12 cases.

The remaining six cases were obtained from the ordinary practice at Moorfields, by the kindness of some of the staff. Much the same methods were employed as in the Egyptian cases, viz., the follicles were expressed, and then agar-plates and peptone-broth inoculations were made. From these, again, fresh inoculations were made on to other media. All the 15 cases suffered from what is generally known as acute trachoma, that is to say, the disease was recent, the lids covered by abundant red fleshy granulations; there was an accompanying mucopurulent discharge, and the subjective symptoms were well pronounced.

As regards the Sattler-Michel micrococcus I have only been successful in isolating it definitely in two cases, both of which occurred at Moorfields. In one of the Egyptian cases it was apparently found, but in spite of every care an absolutely pure culture could not be obtained. In both of the English cases also, in which it was isolated in pure culture, much difficulty was experienced. I should like at this point, to enter a protest against this micro-organism being termed a diplococcus. It was puzzling to find that a micrococcus, which in its biological characters bore out everything that was described as peculiar to the Sattler-Michel coccus, to have, when grown on agar-agar or on blood serum, very definite grouping like a staphylococcus, from which it could not be discriminated. Cultures in peptone-broth or on gelatin did, however, show distinct grouping of the coccus in twos and fours. To clear the point up, Dr. Macfadyen most kindly obtained a pure culture of the coccus from Professor Sattler's laboratory, and, on comparing growths from this tube with my own, I found the same feature present, that is to say, that upon agar-agar and blood serum the coccus was arranged in masses like any staphylococcus, there being only occasional diplococci to be seen, as always occurs in detached fragments of a mass of staphylococci.

Varieties of staphylococci were found in every case,

either the *Staphylococcus pyogenes aureus*, which was present in two cases, or the *Staphylococcus pyogenes albus*. In one or two cases the *Staphylococcus epidermidis albus* was thought to be found. This micro-organism only differs from the *Staphylococcus pyogenes albus* in liquefying gelatin rather less speedily.

Sarcinæ were found in two cases.

Bacilli were found in five cases.

One variety of bacillus encountered was a non-motile bacillus, decolorised by Gram's method of staining. Nutrient gelatin was not liquefied, and gave a plentiful white semiluculent growth. On agar-agar there was produced an uniform dull white cloud-like film, and a very similar growth was obtained on serum. On potato a thick white creamy, though not very abundant growth resulted, and inoculation of milk did not cause coagulation. Inoculation of a pure culture of this bacillus into the conjunctival sac of a rabbit produced a severe reaction, and a fairly profuse muco-purulent discharge; whilst the conjunctival surface became speedily covered by red velvety granulations. The whole process had subsided in about a fortnight, at the end of which period the conjunctiva had regained its normal appearance, and all discharge had ceased.

The *Bacillus mesentericus vulgatus* was isolated from another case; but, of course, this bacillus has no pathological significance. The other varieties of bacilli were not unfortunately followed up to a precise identification. One was a chromogenic bacillus which yields an abundant smooth yellow growth on agar-agar and serum, whilst nutrient gelatin was not liquefied, and only showed a very feeble growth. Each of these varieties of bacilli only occurred in one case, and in putting the cultures aside to be able to recognise any second appearance of the same bacillus in another case, the growth was allowed to die out.

Thus so far, no variety of micro-organism, with the

exception of staphylococci, has been found present in more than two out of the 15 cases. Varieties of staphylococci were found in all cases. It is one of the essential characteristics of any micro-organism for which a definite specific nature is claimed, that it should be found in all well-marked and acute cases of the disease in question, and, as far as my experience goes, the Sattler-Michel coccus is very far from fulfilling this condition.

In short, I have been unable to discover any micro-organism, without reference to any pathogenic properties it may possess, the mere presence of which may be regarded as a characteristic *microscopical* feature of trachoma. As I have, however, already pointed out, my investigations into this subject are at present incomplete.

GENERAL CONCLUSIONS.

Three questions naturally suggest themselves on studying the combined results of the numerous writers on the bacteriology of trachoma.

1. Has trachoma a bacterial origin or not?
2. Has any micro-organism been isolated which may claim to be the etiological factor of the disease?
3. Is it possible that trachoma is induced by a variety of micro-organisms rather than by one definite microbe?

1. *Has trachoma a bacterial origin or not?*

On this point the mass of evidence is largely in favour of a bacterial origin for trachoma, and despite the arguments evinced by Müttermilch and Gunning to the contrary, such an opinion seems almost conclusively proved. The question chiefly turns on the contagiousness or otherwise of the disease. I say chiefly, because we have still to contend with the possible advent of a specific protozoon, though up to the present time all attempts to prove the existence of such a parasite have failed. The evidence

of repeated epidemics of trachoma, and of cases where the disease has spread directly from one person to another of a community are too numerous and well assured to admit of doubt. In all probability the contagiousness of the disease is very variable, being, under certain conditions much greater at one time than another. Thus the disease may assume an acute epidemic form when it appears to be highly contagious, whilst at other times it makes its appearance in isolated chronic cases, lacking the acute symptoms of the epidemic form. In this latter manifestation the conditions favourable for the spread of the disease do not seem to exist, and the power of transmission is much lessened. In such cases only one eye may be affected, though this is rare, and the second eye usually becomes implicated at some later period. The conditions which chiefly influence the contagious character of the disease have been shown to exist in bad hygienic surroundings; and in this respect trachoma does not differ from many well known and undisputedly contagious diseases such as diphtheria and typhoid, plague, and cholera.

Mr. Ridley, in an interesting paper on the histology of trachoma (*Trans. Ophth. Soc. U. K.*, 1894), gives four arguments against the bacterial origin of trachoma. As in these four arguments Mr. Ridley sums up the points that have been most generally adduced against the bacterial theory, I venture to offer a few words of criticism in reply.

He quotes, firstly, the great diversity of opinion as to the etiology of the disease, "that many micro-organisms have been found, that to many a specific nature has been assigned; but in all cases conclusive proofs have been wanting. On the other hand, equally competent observers have found no special micro-organisms."

As regards this point, it must be remembered that one great difficulty in discovering a specific microbe, lies in the resistance offered by animals to the disease. Trachoma, as far as one can judge, is a disease peculiar to man; moreover, the presence of a multiplicity of bacteria is by

no means a conclusive proof of the absence of a specific bacterial process, a point to which I shall refer later.

Secondly, Mr. Ridley suggests that a parasitic Protozoon may be the etiological factor.

The importance of parasitic Protozoa in the causation of disease is now becoming widely recognised, and a parasite has been definitely proved to be the specific cause of malaria; but the presence of a Protozoon of this description in trachoma is, after all, only hypothetical, and the mere possibility of its presence can hardly be used as an argument against the bacterial theory in a disease where bacteria actually abound.

With reference to the possibility of a parasitic origin in trachoma, Mr. Ridley states that "bacterial diseases are usually more easily communicable, whilst those due to Protozoa vary in the extreme." This is a loose statement. Leprosy and tubercle are both bacillary diseases, and both are contagious, though not markedly so; and a man may live for years in close communication with patients suffering from one of these diseases and yet escape contagion. As has already been pointed out, the contagiousness of trachoma is probably very variable, and when one takes into consideration the normal inhibitive power of healthy tissue, one can, at any rate, hardly expect the attenuated virus of chronic and isolated cases to induce trachoma in a healthy conjunctival sac. The only true test of the contagiousness of trachoma lies in the question of its transmissibility in its acute epidemic form; when there can be no reasonable doubt that active agents such as flies, or passive agents such as sponges, towels, &c., *do* directly carry and spread the disease throughout a district or community.

As a third argument, Mr. Ridley cites the great power of trachoma in resisting ordinary bacteria-destroying agents. Here we are confronted by the question as to whether these bacteria-destroying agents do, in a large number of cases, ever reach the true source of disease,

which probably lies in the sub-epithelial layers. If these layers are exposed with a strong solution of corrosive sublimate, then Mr. Kenneth Scott has shown that the disease can be cured by this powerful germicidal agent in a few weeks.

Lastly, the absence of giant cells in trachoma presents a difficulty to Mr. Ridley. He says that "these giant cells seem to him to be the tissue's special means of attacking slowly growing organisms, such as tubercle, while the leucocytes and epithelioid cells suffice for their chemical products only."

Surely this is rather a startling assumption to use as an argument against the bacterial origin of trachoma. There are, no doubt, writers who support Mr. Ridley in his views as to the uses of the giant cells in tubercle; but as regards the object of the leucocytes, a very large and influential school, headed by Metschnikoff and others, believe that the leucocytes are themselves the main agents in attacking and consuming hostile micro-organisms. So that with equal authority one might quote the exudation of leucocytes in trachoma as a proof of the bacterial origin of the disease. However, it would appear that neither the absence of giant cells nor the presence of leucocytes, the exact uses of which are, after all, somewhat hypothetical, can have much weight in the question of a bacterial or non-bacterial origin for this disease.

2. *Has any Micro-organism been isolated which can claim to be the Etiological Factor of the Disease?*

Unquestionably no organism has been isolated which fulfils the necessary conditions appertaining to a specific organism. The bacterium most favoured by the majority of writers is that advanced by Sattler and Michel; whilst many others, including Fuchs, believe the virus to be an attenuated form of the gonococcus. Some writers in relating positive results in their experimental inocula-

tions of animals may have mistaken a severe follicular conjunctivitis with muco-purulent discharge for true trachoma. This variety of conjunctivitis may be induced by many micro-organisms, and I have myself succeeded in doing so with a certain bacillus discovered in one case. Before any micro-organism can have any special claim to be regarded as specific, an histological examination must be made of the follicles, the formation of genuine granulation tissue established, and the organism found reproduced. These conditions have not yet been fulfilled by any investigator.

3. *Is it possible that Trachoma is induced by a variety of Micro-organisms rather than by one Special Microbe?*

The possibility of such a solution of the question is the natural thought that follows a review of the bacteriological history of trachoma. Such a theory implies an origin by *mixed infection*, a condition of which there are some well-known instances scattered through the science of bacteriology. For example, the alliance of a streptococcus with the Klebs-Loeffler bacillus is responsible for certain special clinical symptoms that may complicate diphtheria; and we further believe that the union of a streptococcus with the unknown specific organism of scarlatina is the specific cause of scarlatinal nephritis. The clinical symptoms of pure streptococcic infection are either those of a general acute septicæmia or of a local erysipelas; but when the organism becomes associated with the Klebs-Loeffler bacillus or the supposititious scarlatinal organism, the result is not an acute septicæmia or a local erysipelas added on to the ordinary clinical manifestations of diphtheria or scarlatina, but the production of new and special symptoms due to the alliance of two distinct pathogenic organisms.

If we apply this theory to trachoma, we note two main clinical features of the disease. Firstly, we have a

muco-purulent discharge and a coincident inflammation of the conjunctiva; and, secondly, we see the special manifestation of trachoma in the presence of bunches of granulation tissue which are known as the trachoma follicles.

Now, all the known specific agents of a muco-purulent conjunctivitis have been found and isolated in trachoma, staphylococci and streptococci in several varieties, Weeks' bacillus, and other varieties of bacilli which are known to produce a muco-purulent conjunctivitis, but which have not been identified with any special form of inflammation. Any of these organisms, then, may produce a muco-purulent conjunctivitis, but not any single one, apparently, may produce trachoma. It is possible, perhaps even probable, that the accidental union in the conjunctival sac of two or more of these pathogenic organisms may be the specific cause of the special features of trachoma.

This theory of the mixed infection of trachoma must rest for the present on an hypothetical basis; but, at least, it opens up a fresh field for investigating the origin of the disease, a field which, I venture to believe, will not be unproductive in its results.

It is worthy of note that during the last few weeks, L. Müller, of Vienna, has published a paper alleging his discovery of a specific bacillus in trachoma (*Wiener klinische Wochenschrift*, 1897). Unfortunately the publication is too recent for me to be able to obtain it in time for this paper.

DESCRIPTIVE CATALOGUE OF SPECIMENS IN THE
HOSPITAL MUSEUM (*continued*).

By C. DEVEREUX MARSHALL, *Curator*.

SERIES I.

Subseries (A)—continued.

No. 32 (4542).—The lateral half of the right eye of a woman, aged 66, who was struck with a piece of wood she was chopping. The eye was extremely painful, and the sight was lost a week after the accident. Excision was performed two weeks later. Tension +2. The cornea is very steamy, and the lens is lying in the anterior chamber and completely filling it. The iris is tightly stretched behind it, but at the periphery it is lying against, and adherent to, the cornea, thus closing the angle of the anterior chamber. The ciliary body is stretched and thin, and microscopically it is seen to be much inflamed.

No. 33 (4413).—Lateral half of the left eye of a man which was injured nine years ago by a piece of wood that he was chopping flying up and striking it. The sight gradually failed after this. It has lately given rise to much pain. The globe is somewhat enlarged, the sclera is bulged in places, and the anterior chamber is rather deep. The lens is displaced, calcareous, and very hard. The vitreous is detached and shrunken, but it is adherent to the disc and a portion of the retina near this. The retina is *in situ*.

No. 34 (4300).—The lateral half of the left eye of a youth, aged 17. It was struck with a stone thrown from a catapult seven years previously; the sight failed about two years later. The cornea is clear, and the anterior chamber is of irregular depths; iris *bombé*. The angle on both sides is closed by adhesion of the root of the iris to the cornea. The lens is opaque and calcareous at its periphery. The retina is detached

from the optic disc to the ora serrata. The cell elements appear microscopically to be diminished, but the interstitial tissue is increased.

No. 35 (4505).—Section of the left eye of a man, aged 24, which was injured 10 years before excision with a squib. For two years it has been quite blind. The eye was very painful and inflamed when removed. The angle of the anterior chamber is entirely closed by adhesion of the root of the iris to the cornea. The iris is *bombé*, and the pupil is entirely bound down to the lens capsule. The lens was lying in the cavity seen, but it was calcareous, and has since become displaced. The retina is detached from the optic disc to the ora serrata, and on one side there is a large cyst in it. The subretinal space was filled with a mass of coagulated albuminous material. Microscopically it is seen that the iris is atrophied, the ciliary body, choroid, and retina are all thickened and infiltrated, but there are no small retinal cysts as is usually the case.

No. 36 (5044).—The right eye of a man, which had been blind for 20 years after having received several blows upon it. The anterior chamber is shallow. The lens is calcareous. The choroid is detached, and beneath it is a mass of blood clot behind and jelly-like material at the sides; in the choroid itself is a large mass of bone forming a cup, and in the middle of this there is a large quantity of cholesterine which has an opalescent appearance.

No. 37 (4825).—Section of the eye of a man, which was struck with a piece of wood seven years ago. The anterior chamber is very deep. The iris is much atrophied. The lens is absent. On careful inspection the vitreous is seen to form an umbrella-shaped detachment with its apex at the disc. There are some small patches of choroiditis.

No. 38 (5103).—Section of an eye of a man, aged 78, who suffered from a traumatic ulcer of the cornea. The cornea is destroyed, and the retina and choroid are detached. The ciliary nerves can be seen stretching across the subchoroidal space.

No. 39 (172 O.P.).—The eye of a gentleman, who became suddenly blind in this eye when diving, 30 years before removal. At that time a large hæmorrhage had taken place into the vitreous. The anterior chamber is of moderate depth, but the angle is somewhat narrowed. The lens was calcareous, but the capsule now only remains, the lens matter itself having come away in fragments. The vitreous, which has now been removed, was opaque and rather dense. In the choroid is a large bony plaque. There is extensive retino-choroiditis, and the retina is so altered and adherent to the choroid as to be hardly recognisable.

No. 40 (5268).—Right eye of a man, aged 54, which was struck with a flat piece of wood four years ago—it was quite healthy until that time. The left eye is myopic to the extent of about -3 D. The eye is soft; tension -3 . The cornea is hazy, and the anterior chamber is very shallow. Total posterior synechiæ. The lens, which is now displaced with its anterior surface visible, is in a large space bounded in front by the iris and ciliary body, and behind by a dense cyclitic membrane. There is an anterior polar opacity also present. The cyclitic membrane has undergone some contraction, and this has led to the detachment of the adjacent choroid. It forms the anterior boundary of a rather larger cavity, which is full of cholesterine. The retina is indistinguishable even microscopically.

SERIES I.—*Subseries (C)—continued—Eyes not containing Foreign Bodies.*

No. 45 (4834).—Section of the eye of a boy, aged 14, which was wounded with a stone 11 years before removal. It was increasing in size and also becoming painful. The eye is much enlarged in all directions. The cornea is thin, and with the much thinned ciliary region forms a large anterior staphyloma. The iris is very atrophied, and is adherent to the cornea. The lens is opaque and shrivelled, and is displaced somewhat to one side and held there by the suspensory ligament. The vitreous

is fluid and degenerated. The retina and choroid are intact, but both much atrophied. The optic disc is deeply cupped.

No. 46 (66 O.P.).—The eye of a boy, aged 17, which was injured four years ago by a pen which penetrated close to the corneo-scleral margin. It hardly touched the lens, but caused a small and localised opacity at the spot. The eye remained quiet until it was struck about two weeks before excision; it then became inflamed, and was excised. The track of the pen through the periphery of the lens back into the posterior part of the ciliary region is well seen.

No. 47 (4952).—Section of the eye of a man, aged 21, whose eye was injured 14 years previously with a fork. The lens became dislocated into the anterior chamber, and the eye then became painful. The anterior chamber is very deep, but the lens which was in it has fallen out; it was hard and calcareous. The retina is entirely detached, and the vitreous chamber is much contracted. In the choroid a large plate of bone is developed.

No. 48 (4807).—The eye of a man, aged 24, which was injured 16 years before excision. It remained quite quiet until seven days ago. A large mass of cholesterine then appeared in the anterior chamber, and the eye became inflamed. There is a wound of the cornea with an anterior synechia attached to it. A large quantity of cholesterine was in the anterior chamber, and the subretinal space was nearly full of it, but has all got washed away except a small quantity in the anterior chamber. The lens is much degenerated, and the retina is detached from the optic disc to the ora serrata.

(Reported in Ophth. Soc. Transactions, vol. xvi, p. 362.)

No. 49 (5056).—The left eye was cut with a piece of copper five days before excision. An iridectomy for the prolapse was done. The wound is seen to extend through the cornea, iris, and lens, the latter being divided into two unequal halves. The vitreous is healthy, and the retina and choroid are *in situ*.

No. 50 (4884).—Section of the eye of a man which was

injured nine years ago with a stone, since which time it has been shrinking. The cornea is flat, and the iris is adherent to it. The lens is absent, and the retina forms a solid mass which is detached except at the disc and at the anterior part. The choroid contains a thin plate of bone which has fallen forwards against the glass.

No. 51 (5071).—Section of an eye which was injured five years ago. There was no P.L., and T. was -3 . There is an extensive wound reaching across the cornea, the scar of which is seen in the section; the iris is adherent to the back of the cornea. The lens is almost entirely absorbed, and what remains is quite opaque. The retina is entirely detached from the optic disc to the ora serrata, and the subretinal space is filled with coagulated albuminous material in which crystals of cholesterine are visible.

No. 52 (5081).—Eye wounded three months before excision; it is somewhat shrunken. The lens is dislocated. The vitreous is absent. The retina and choroid are detached.

No. 53 (4980).—Section of an eye injured by being struck with a brick. The eye has two lateral staphylomatous bulgings. The iris is greatly atrophied. The lens is dislocated into the subretinal space. The retina is completely detached between the optic disc and the ora serrata.

No. 54 (4908).—The eye was injured three weeks before excision by a piece of steel. An ulcer with hypopyon followed, and this destroyed the cornea. There is much lymph about the wound, and the lens is lying between its lips where it is caught and moulded. The retina is slightly puckered.

No. 55 (5011).—The eye of a child, aged 18 months. Six months previously it was injured with a pair of scissors. The cornea is wounded, and to this the iris and some capsule is adherent. The lens is absent. An extensive scar is seen running from the wound across the retina and choroid to rather beyond the equator. The vitreous is degenerated.

No. 56 (4429).—Eye of a young man which was wounded

by a piece of a rivet; a small piece of metal was removed with the magnet. The eye did not recover, and was removed. The lens is absent, and there is much inflammatory exudation around the ciliary body. Stretching between the O.D. and the remains of the lens is the coiled up and detached hyaloid membrane.

No. 57 (4834).—The eye of a boy, aged 14, which was injured with a stone when he was three years of age. The eye is greatly enlarged in all directions; the cornea is thin and bulged, and to this the iris is adherent, the thinning affects the ciliary region, and thus forms a large anterior and ciliary staphyloma. The remains of the lens, which is much broken up, can be seen at the lower part of the preparation. The vitreous is greatly degenerated. The retina and choroid are *in situ*, and the optic disc is deeply cupped.

No. 59.—Section of an eye which was wounded through the cornea and pupil. The lens is opaque, and is breaking down at the posterior part, and here commencing to suppurate. There is an anterior capsular synechia adherent to the wounded cornea.

No. 60 (5288).—Eye of a boy, which has a large wound of the cornea. An iridectomy was done, but the iris is not free. The lens is wounded, and two fine capsular synechiæ reach forwards, and are adherent to the corneal wound.

No. 61 (5330).—Eye of a woman, aged 21, which was injured 16 years ago with a shrimp's head, and has been blind ever since. The cornea and iris are adherent, and the lens has nearly disappeared. The vitreous has degenerated, and the hyaloid membrane is detached and runs forwards like a cord for some distance, and then expands into a conical form (this can only be seen on close inspection). There is much inflammatory exudation covering the ciliary body.

SERIES I.—*Subseries (D)—continued—Eyes containing Foreign Bodies.*

No. 23 (4633).—The lateral half of the left eye of a man,

aged 49, which was struck with a piece of steel 16 days before excision. It caused a wound of the sclerotic $\frac{3}{8}$ inch to the inner margin of the cornea. Lying at the lower part of the ciliary body is a piece of steel, 13 mm. long and $3\frac{1}{2}$ mm. wide. There is some hæmorrhage into it. The lens has escaped injury.

No. 24 (4608).—The lateral half of the left eye of a man, which was injured with a piece of steel six years ago. The anterior chamber is of irregular depth, and the iris is bulged, the angle is closed on both sides, and the pupil is completely blocked and bound down to the anterior capsule of the lens. Lying embedded in the sclerotic and projecting into the vitreous is a splinter of metal, but it does not project on the outer side at all. The vitreous was rather fluid and the O.D. deeply cupped.

No. 25 (4607).—A month before excision patient was struck in the right eye with a piece of metal. The cornea, iris, and lens were wounded. Lying at the lower part of the vitreous chamber, and in contact with the ciliary body, is a piece of iron surrounded by lymph. The vitreous is degenerated, and the retina is somewhat detached.

No. 26 (4925).—Three weeks before excision the left eye was struck with a piece of tin. There is a punctured wound of the cornea with a prolapsed iris. The lens is wounded opposite this, and the opacity is seen extending from it. A fragment of metal is lying in the ciliary body opposite the point of entry.

No. 27 (5037).—Four weeks before excision a piece of metal flew off a lath and struck the left eye. Situated by the ciliary body, and just behind the lens, is a small fragment of iron. The vitreous is shrunken and detached. The retina is *in situ*, and the choroid is slightly detached from the sclera in front.

No. 28 (3871).—Section of the eye of a man who was fired at in the face by a poacher standing 3 yards away with a blank charge. The cornea, iris, and lens are wounded, and several grains of gunpowder are in the vitreous. This is much

infiltrated with inflammatory material. The retina and choroid are *in situ*.

No. 29 (5063).—Section of the eye of a man which was wounded with a piece of steel. The corneal wound is seen, and, spreading backwards from it, is pus and inflammatory exudation. The retina at the posterior part is greatly thickened. The foreign body is covered with lymph, and is not seen.

No. 30 (4925).—The eye of a woman, aged 23, which was wounded with a piece of tin, which penetrated. There is a punctured wound at the upper and inner corneo-scleral junction (seen on one side of the specimen), and in this the iris is prolapsed. The lens is wounded, and is becoming opaque. Suspended in the vitreous was an irregular-shaped piece of metal which is not now present. The retina is somewhat detached.

No. 31 (4865).—In 1893 the eye was struck with a piece of metal which flew off as he was shoeing a horse; this caused a traumatic cataract, for which he was treated here. Two years later the eye became blind, and has lately assumed a rusty colour, and in March, 1896, it became painful and was excised. The lens is *in situ* and uninjured. The iris and vitreous are very rusty in appearance. A fairly large-sized chip of metal is lying embedded in the ciliary body. The retina and choroid are *in situ*.

No. 32 (162 O.P.).—About four years before excision patient (a woman, aged 34) received a blow in her left eye with a tumbler which was thrown. The eye has recently become inflamed, and, as there were signs of early sympathetic ophthalmia, it was removed. The globe is shrunken and the lens calcareous. Situated at the back of the globe in the orbital fat are two large pieces of glass which are encapsuled, this is partially dissected off so as to show the foreign bodies. These pieces have penetrated the eyeball and passed completely through it. (Specimen in spirit.)

(Reported in Trans. Ophth. Soc., vol. xvii, 1897.)

SERIES I.—*Subseries (E)—continued.*

No. 5 (4939).—Section of an eye which had been injured with lime several years ago. This had induced traumatic iridocyclitis. The eye was excessively irritable. The anterior chamber is shallow, and there are numerous posterior synechiæ. The pupil is blocked. The retina forms an umbrella-shaped detachment with cysts developed in it. The subretinal space was full of coagulated albuminous material.

Series I—Subseries (F) —continued.

No. 39 (4585).—The lateral half of an eye of a female, aged 59, who twice underwent the operation of couching for cataract at the hands of "an Indian oculist" during the two months before excision. It has been blind and painful ever since. A good deal of pigmented deposit is seen on the back of the cornea. The anterior chamber is very deep. The displaced lens is lying against the detached retina, and really in the subretinal space. The retina retains its attachment only to the optic disc behind and to the ora serrata on one side in front.

No. 40 (4650).—Section of the eye of a man, aged 68, who had a cataract extracted here in October, 1894, and afterwards could see 6/12. Six months later the sight became very dim, and an extensive detachment of the retina was visible. V. = hand-movement. T. —2. The iris and cornea are in contact; no anterior chamber Aphakia. The retina and choroid are detached, but are held down at four places, these being the positions where vessels perforate the sclera; there are thus four balloon-shaped detachments of the choroid and retina. Some of the ciliary nerves are seen stretching across the subchoroidal space.

(Reported in Trans. Ophth. Soc., vol. xvi, 1896.)

No. 41 (4625).—The lateral half of the left eye of a man, aged 20, who underwent iridectomy for chronic glaucoma. The eye immediately became painful and blind. There is no

anterior chamber. The retina and choroid are both entirely detached by an enormous subchoroidal hæmorrhage. The ciliary vessels and nerves are seen stretching across the subchoroidal space.

(Reported in Trans. Ophth. Soc., vol. xvi, 1896.)

No. 42 (4621).—The lateral half of the eye of a man who, nine weeks before excision, had iridectomy done (probably for glaucoma or iritis), shortly after an attack of rheumatic fever. The globe is shrunken. T. —3. There is a coloboma of the iris upwards, with the remains of lens matter and inflammatory products in it, and in the pupil. The retina is drawn forwards and detached, and there is some blood-clot outside this. The choroid is to a great extent detached; on one side there is a large cavity left, which is divided by two bands stretching across it into three spaces. On the other side there are two smaller spaces. Microscopic examination shows that the walls of these are composed of delicate connective tissue, being evidently the much thickened lamina suprachoroidia. These cyst-like spaces have no endothelial lining.

(Reported in Trans. Ophth. Soc., vol. xvi, 1896.)

No. 43 (4855).—Lateral half of the eye of a man, aged 74, who had a cataract extracted elsewhere four months before excision. The eye has been very painful ever since that time. T. +. The anterior chamber is almost obliterated, the iris and cornea being in contact. There is a coloboma on one side, and the opposite pupillary edge of the iris is connected with the scar of the extraction wound by means of a cyclitic membrane, being formed partly of lens capsule. The vitreous is shrunken and degenerated. The retina and choroid are *in situ*. The optic disc is slightly cupped.

No. 44 (4860).—Section of the eye of a woman, aged 47, who had iridectomy for glaucoma performed two months before excision. The eye did not do well, and the scar bulged. T. +3. Cornea steamy. V. = hand-movement. A coloboma is seen upwards, and the iris here has been removed well up to the angle, but the lens has become displaced into the wound and is blocking the angle again and causing the scar to bulge. The

iris on the opposite side is adherent to the periphery of the cornea. The vitreous is healthy, and the retina and choroid are *in situ*. The optic disc is deeply cupped.

No. 45 (4981).—Section of the left eye of a woman, aged 82 an inmate of a workhouse, who was suffering from cataract, complete in the left eye, and commencing in the right. She was in very fair health, and the tension and projection were quite good. Eye slightly myopic. The extraction was uncomplicated, but some soft matter was left. The eye did not do well, and remained soft and injected. It was removed on account of pain twelve days later. The iris and some lens matter is drawn towards the wound, which is flat. The angle of the anterior chamber on the side opposite the iridectomy is widely open. There is severe inflammation of the ciliary body, and much blood exuded into it. The retina and choroid form together large, balloon-shaped detachments, and the sub-retinal space thus left is filled with exudation containing a considerable amount of blood. Some exudation of a similar nature is seen microscopically to be between the retina and choroid.

No. 46 (4839).—Section of the right eye of a child, aged 5, who during four years has had numerous operations for congenital cataract. She developed glaucoma, and then the eye shrank. The eye is badly developed, but the cornea and sclerotic are much thickened. The remains of the lens matter and capsule remain; but are thickened with inflammatory material; the iris is also adherent to this. The retina is considerably detached, so also is the anterior part of the choroid.

No. 47 (4623).—Section of the eye of a man, aged 74, whose right eye was operated on for cataract without iridectomy. A good deal of soft cortex was left behind, and this was subsequently evacuated, and the capsule was needled. The eye, which at first had V. = 6/18 J_i, got painful, and the sight failed. T. + 2. Some blood is present in the anterior chamber. The pupillary edge of the iris is adherent to the capsule, and there is a *bombé* iris. The vitreous is fluid, and the retina and choroid are *in situ*; both of these structures, and also the ciliary body, show microscopically much inflammatory change.

No. 48 (5058).—Section of the eye of a very alcoholic man, who did well after an extraction three years ago. The capsule was then needled. The eye at once suppurated. The whole vitreous, extending as far forwards as the lens capsule, is purulent; the retina is much thickened, and both it and the choroid are slightly detached.

No. 49 (5104).—Section of the eye of a woman who underwent the operation of cataract extraction without complication. Shortly afterwards purulent infiltration commenced about the wound. The eye did not suppurate, but became quite blind and painful, and then shrank. The retina is entirely detached; the choroid is also detached, but not so completely. The ciliary nerves can be seen stretching across the subchoroidal space.

No. 50 (5153).—The left eye of a man, aged 35, which had been operated upon for cataract 20 years previously. The eye did badly, and has lately been painful. T. +. There is an enormous staphyloma at the upper ciliary region. The iris is extremely atrophied. The vitreous is degenerated, and contains blood. The retina and choroid are atrophied, but *in situ*.

No. 51 (5151).—Eye of a man, aged 52, who was operated upon for cataract (at which he lost vitreous) eight years before excision. The eye became painful after a blow two weeks before removal. Tension full. There is a coloboma of the iris on one side, the remaining iris being atrophied and adherent to the cornea. The lens is absent, but a considerable amount of lens matter remains in the capsule; this has mostly been reformed since the extraction. There is an extensive, though shallow, detachment of the retina, on which are numerous hæmorrhages. The vitreous is fibrous and degenerate. The optic disc is deeply cupped.

No. 52 (4035).—The left eye of a man, aged 33, which had been operated elsewhere four years ago for glaucoma. The operation done was sclerotomy, the iris being left in the wound. There is an enormous cystoid scar at the upper part; the much atrophied iris is seen adherent to its inner surface.

The angle of the anterior chamber appears to be open on the opposite side. The lens is *in situ*, and the vitreous shrunken and detached. The cystoid scar is composed of vascularised fibrous tissue. The retina and choroid are *in situ*.

No. 53 (2989).—Eye of a boy, aged 6, which was needled five years before removal, for cataract. This was followed by severe irido-cyclitis. Stretching across the iris is a dense cyclitic membrane. There is hardly any lens matter remaining. Covering the whole of the ciliary region and the adjacent choroid is a layer of inflammatory exudation; the retina is somewhat drawn forwards in front, but is *in situ* behind. The choroid is much atrophied.

No. 54 (5104).—The eye of a woman, aged 63, which was operated on for cataract (extraction) a month before removal. The eye became infected, suppurated, and then shrank. The sclerotic is much puckered. The retina and choroid are both detached, and the ciliary vessels and nerves can be seen stretching across the subchoroidal space.

No. 55 (155 O.P.).—Eye of a woman who suffered from glaucoma, and for which iridectomy was done. The wound became infected and bulged; the remains of the iris and ciliary body are seen to be prolapsed into the suppurating wound.

No. 56 (5346).—The eye of a woman, aged 78, who had a cataract extracted with iridectomy nine months before excision. Iritis followed three months later. The iris is *bombé*, and adherent to a cyclitic membrane, which completely blocks the pupil. The retina and choroid are *in situ*, and the fundus is healthy.

SERIES II.

Subseries (A)—continued—Inflammation following Ophthalmia.

No. 40 (4320).—The lateral half of the eye of a man, aged 24, who had an attack of purulent ophthalmia, and lost the sight four years before excision. The globe was very

adherent to the orbital tissues; the cornea is thin, and shows many interesting microscopic changes in all parts (see Curator's Report). The anterior chamber is on one side, rather shallow, but it is obliterated on the other side. The lens is shrunken, and there is a dense cyclitic membrane. The retina forms a cord stretching from the optic disc and then spreading out somewhat when it reaches the back of the lens; one process stretches downwards, and has become adherent to the choroid.

No. 41 (4609).—Lateral half of the eye of a man, aged 22, which was severely inflamed five years ago. A month before excision he had a blow, which caused it to become painful. The cornea is shown microscopically to be thickened and inflamed. The anterior chamber is deep, and contains a mass composed partly of crystals of cholesterine—it is apparently degenerated blood clot. The iris is very much thickened and retracted, and scarcely projects beyond the ciliary body, which is very much inflamed. The retina contains some cysts, and is completely detached, except at the optic disc. Both it and the choroid are so altered by cell infiltration, &c., that their structure can barely be made out.

No. 42 (5086).—Eye of a man, aged 74, who had suffered from ulceration of the cornea for three weeks; the eye was cataractous and blind previous to this, and the cornea was very nebulous. The cornea is almost entirely destroyed, and the lens has escaped. The retina and choroid are adherent to each other and detached from the sclerotic; a ciliary nerve can be seen running through the subchoroidal space. At various places the choroid is held in contact with the sclerotic by vessels and nerves which are entering and leaving the globe. It is impossible to be sure whether the choroid was or was not detached before the ulcer perforated.

No. 43 (4942).—Section of an old inflamed eye, which had recently become very painful. T. + l. The iris is *bombé*. The lens is opaque, but *in situ*. The retina is completely detached from the optic disc to the ora serrata, and the sub-retinal space contains a quantity of cholesterine.

No. 44 (5106).—Two eyes of the same patient, a boy, aged 12, which had been affected since early infancy. Both being painful and blind, they were excised.

(a) The right eye is represented only by a very much shrunken globe, which is solid throughout. The sclerotic is much thickened. The remains of the lens is calcareous, and there is some bone developed in the choroid.

(b) The left eye is nothing like so much shrunken. The anterior chamber is very deep, and contained a quantity of blood, which has now been removed. Covering the iris and pupil is a thick layer of organised lymph. The lens is surrounded by inflammatory material. The retina is entirely detached, and the choroid has numerous colloid nodules on it. The sub-retinal space contained a quantity of cholesterine.

* No. 45 (5110).—Eye of a child, aged 9 years, who suffered in infancy from ophthalmia neonatorum. It had recently become inflamed and painful. The cornea is opaque, and the remains of the greatly atrophied iris is adherent to it. Immediately behind this (in the place where the lens should be) is a mass of inflammatory exudation, which extends backwards to the ciliary body and vitreous. The vitreous itself is shrunken, and the hyaloid membrane detached. The retina and choroid are inflamed but *in situ*.

No. 46 (5143).—Eye of a child, aged $3\frac{1}{2}$ years, who had suffered from extensive ulceration of the cornea six months before excision. The cornea and iris form a large anterior staphyloma. The lens is *in situ*, but stretching from its anterior surface to the staphyloma is a thin thread, which marks the centre of an anterior polar cataract, thus showing how it was formed; this synechia is 4 mm. long. The vitreous is healthy, and the retina and choroid show no naked eye changes, though inflammatory changes are visible microscopically.

No. 47 (2974).—Eye of a man, aged 70, which was lost four years before excision as the result of "a cold," (probably a perforated ulcer). The eye is puckered and flattened from before backwards. The retina and choroid are both detached, and the subchoroidal space is filled with dense whitish opaque

tissue, which is seen to consist microscopically of fine connective tissue and coagulated fibrinous material.

* No. 48 (5218).—Eye of a boy, aged $3\frac{1}{2}$ years. The cornea has been entirely destroyed by ulceration. The vitreous and lens are absent. The retina and choroid are entirely detached, leaving the sclerotic bare. The posterior ciliary vessels and nerves are seen stretching across the subchoroidal space.

No. 49 (5261).—Eye of a girl, aged 15, who suffered from ophthalmia and ulceration of the cornea for 17 days. At the inner side of the cornea there is a large perforation with a prolapse of the iris and ciliary body. The lens is *in situ* and the back part of the eye is healthy.

SERIES II.—*Subseries (B)—continued.—Febrile Disease.*

No. 28 (4414).—The lateral half of the eye of a girl, aged 8. The eye had been blind for four years, following an attack of whooping cough. It again became inflamed two weeks before excision. There is a large anterior and ciliary staphyloma, the apex of which has perforated. The lens has escaped. The vitreous chamber is filled with pus and organised lymph, which is more dense at the front and lateral parts than behind. There are numerous retinal hæmorrhages; the retina itself is thickened and slightly detached, except at the optic disc.

No. 29 (4554).—Both halves of the left eye of a girl, aged 20. The sight was lost after an attack of measles which occurred in infancy. In one preparation the lateral half is shown. The cornea is very much thickened, and the iris, which is excessively atrophied, is adherent to its posterior surface, the two together forming an anterior staphyloma, which is nearly as large as the rest of the eye. The lens is situated at about the junction of the anterior and middle thirds of the globe. The retina is *in situ*, but there are many patches of retino-choroiditis at different parts of the fundus. The other preparation shows the condition at the ciliary region. The suspensory ligament is enormously stretched, and when held up to the light the condition resembles a spider's web.

No. 29a (4632).—Half the ciliary region and lens of the right eye of a female, aged 23. The eye had been blind since infancy. The cortex and nucleus of the lens are shown, together with the ciliary processes and suspensory ligament.

No. 30 (4572).—Lateral half of the eye of a baby, aged 3 months. Five days before excision the eye became inflamed and the lids swollen. It had convulsions during the night, and appeared to be in pain. When the eye was removed there was every sign of commencing orbital cellulitis. On removal there was found to be no pus in the orbit. The pupil was quite blocked. On section the globe is seen to be suppurating throughout; the optic nerve is swollen; the retina is very thick and detached, and there is much pus both in the vitreous and also in the subretinal space.

No. 31 (4452).—Section of the eye of a man, aged 64, who had an attack of erysipelas four years before excision. It then became blind, and he has had several attacks of kerato-iritis since. The eye was very soft, and the cornea small and opaque. The anterior chamber is shallow, and contains some blood. The lens is displaced somewhat laterally. The vitreous chamber is contracted, but it is filled with blood clot. The retina is detached from the optic disc to the ora serrata, and the subretinal space contains a quantity of altered blood clot.

No. 32 (4580).—Section of the eye of a child, aged 8 weeks, who appeared to have glioma of both eyes. This eye (the left) was excised. The anterior chamber is very deep, but the angle is narrowed. The iris is shrunken and atrophied. The retina is detached and reaches from the lens to the optic disc. Microscopically the angle is seen to be quite closed, and the ciliary body is drawn out of position by the shrinking retina. There is some inflammatory exudation connecting these two structures, and some hæmorrhage in it. The retina is infiltrated throughout with small round cells.

No. 33 (4451).—Section of the eye of a child, aged 18 months. About a week before excision it became inflamed. Previous to this it was supposed to be healthy. The retina is entirely

detached from the optic disc to the ora serrata. The lens is quite clear, and the subretinal space is filled with coagulated albuminous material. The choroid is *in situ*, and much marked with old patches of choroiditis. Microscopically inflammatory changes are seen, and at a point, just behind and to one side of the lens, there is a cyst developed in the retina.

No. 34 (5073).—Section of the right eye of a child, aged 5 years, which was noticed to be defective for five weeks. A dull reflex was seen, and the appearance suggested glioma. T. +. The section shows that the anterior chamber is deep and the lens *in situ*. The retina is completely detached from the optic disc to the ora serrata, and some cysts are developed in it. The choroid is thin and shows marked inflammatory changes.

No. 35 (4237).—Section of the eye of a girl, aged 13, which was lost nine years previously, after measles. There is no anterior chamber. The lens is calcareous. The retina is fibrous and forms large bands of tissue running more or less in the antero-posterior direction.

No. 36 (4853).—Remains of the eye of a child, aged 3, who has recently suffered from measles and otorrhœa. The cornea is quite destroyed, and the contents of the globe, which is suppurating, are protruding through the necrosed tissue. Some orbital tissue has been removed, and this is quite dense and hard, as the result of inflammatory exudation.

No. 37 (5282).—Right eye of a child, aged $2\frac{1}{2}$, which was first noticed to be affected eight months ago. The pupil when seen was dilated, and a white mass, with reddish areae like small hæmorrhages, was seen. T. +. The left eye was unaffected,—glioma was diagnosed. The cornea is clear and the anterior chamber is deep. Pupil dilated. Lens *in situ*. The angle of the anterior chamber is closed. The retina is entirely detached from the optic disc to the ora serrata and forms a cord running from before backwards. The subretinal space was filled with dense coagulated material.

No. 38 (5306).—Eye of a child aged 7 weeks, which had the appearance of a glioma. The tension was slightly increased. The anterior is about normal in depth, but the angle is closed by adhesion of the periphery of the iris to the cornea. The lens is *in situ*. The retina is completely detached from the optic disc to the back of the lens, and vessels are seen in it as well as several cysts. The choroid is much atrophied and the subchoroidal space is filled with coagulated albuminous material.

(Reported in Trans. Ophth. Soc., 1898.)

SERIES II.—*Subseries (C)—continued.—Tubercular.*

No. 8 (4530).—The lateral half of the eye of a boy, aged 2 years, which had been inflamed for six weeks. There is a doubtful history of phthisis on the mother's side, but a very strong history on the father's side. No evidence or history whatever of syphilis. The cornea is clear, but the pupil is displaced and fixed. The cavity of the globe is divided into parts by a septum, and in the centre of each there is more or less of a space containing a quantity of semi-purulent broken-down material; the walls are composed of a thick gelatinous sort of material, and in it is probably the remains of the retina and choroid. Microscopic examination shows that the iris and ciliary body are very much inflamed and infiltrated, as also is the lens. The mass occupying the interior of the globe is composed of small round cells in a fibrinous ground substance, and numerous giant cells which have many nuclei arranged around the periphery of the cell; around this are a few epithelial cells and thin masses of small round cells outside these again; there are many of these more or less complete tubercle systems. The internal part is very degenerate, and scarcely takes the log-wood stain at all.

(Reported in Trans. Ophth. Soc., vol. xv, 1895.)

No. 9 (4666).—The lateral half of the eye of a child, aged 17 months. She has been treated for pulmonary tuberculosis, and there is a strong family history of tuberculosis on the father's side. The cornea and lens are clear. The retina is

completely detached, but at the posterior pole there is a large, firm, yellowish-white mass.

Microscopic Examination.—The iris is much atrophied and there is well marked ectropion of the uveal pigment, both it and the ciliary body being much inflamed. The choroid is separated from the sclera in parts by fibrinous exudation; it is much inflamed; it runs into the large mass at the back, which is chiefly composed of large round and spindle cells, together with a good many giant cells. The central portion of the mass is degenerate, and does not stain well with logwood. The posterior part of the retina is involved in this mass, and the rest of it, although detached, is not much altered in structure.

No. 10 (166 O.P.).—Section of the eye of a very feeble child, aged 8 months, which had been inflamed for a few weeks. Growing from the iris and occupying the anterior chamber is a cheesy looking mass which has perforated the sclerotic, and forms a ciliary and corneal staphyloma. Microscopically it is seen to be composed of typical tubercular tissue.

(Reported in Ophth. Soc. Trans., vol. xvii, 1897.)

SERIES II.—*Subseries (D)—continued.—Syphilitic.*

No. 16 (4341).—The lateral half of the eye of a man, aged 24, who was the subject of inherited syphilis, and had suffered from interstitial keratitis. The cornea is opaque, bulged and vascular. The anterior chamber is obliterated. There is a coloboma on one side, but the stump of the iris remains. The lens is pressed forwards, and is almost in contact with the cornea. The ciliary processes are compressed, and the retina and choroid are thin and atrophied. The optic disc was slightly cupped.

No. 17 (144 O.P.).—Specimen presented by Mr. J. R. Lunn. The eye was from a man who suffered from iridocyclitis, probably of syphilitic origin. The anterior chamber is very deep (7 mm.), and was full of a thick, semi-opaque, gelatinous material. The tension was +1. The iris and lens are driven back. The vitreous is opaque. The retina and choroid are both somewhat detached.

No. 18 (5106).—Eye of a girl, aged 14, who had an attack of interstitial keratitis seven years ago. The eyes have been red and inflamed off and on ever since. She has typical signs of congenital syphilis. The eyeball is much enlarged; the antero-posterior diameter is 33.5 mm., transverse 26 mm. The cornea, which measures 16 mm., is opaque, and the iris is in contact with it for a large part of its extent. The lens is *in situ* and the vitreous degenerated. There are several patches of retino-choroiditis scattered over the fundus. The optic disc is not cupped.

SERIES II.—*Subseries (E)—continued.—Sympathetic.*

No. 14 (4384).—The lateral half of the eye of a patient who was suffering from sympathetic trouble in the other eye on account of cyclitis in this one. There are no further details of the history obtainable. The cornea is thickened and the anterior chamber full of coagulated material. Microscopically the angle of the anterior chamber is seen to be closed by adhesion of the root of the iris to the cornea, the pupil is occluded by lymph; the iris being greatly atrophied. The ciliary body and ciliary processes are infiltrated with small round cells, and the whole of the vitreous chamber is filled with old blood clot. The retina is *in situ*, and the optic disc is slightly cupped.

No. 15 (3343).—Section of the eye of a girl which was affected probably with a perforated ulcer in infancy. Shortly after its removal sympathetic ophthalmia developed in the other eye. The eyeball is disorganised and is almost solid, as the result of inflammatory mischief. The lens is opaque and shrunken.

4329
No. 16 (3343).—Eye of a woman which suffered from sympathetic ophthalmitis following cataract extraction in the other eye and subsequent iritis. This eye became involved two months after the primary operation: it was then excised. The cornea, iris, and lens are all matted together. The retina is entirely detached, and is lying as a cord between the optic disc

and the back of the lens. The subretinal space was filled with coagulated albuminous material.

SERIES III.

Subseries (A)—continued.—Primary Glaucoma in Adults.

No. 19 (4619).—Lateral half of an eye for which iridectomy for glaucoma was done three months before excision, after a preliminary scleral puncture. The eye remained irritable and the iris more and more drawn up into a large cystoid scar. There had lately been much pain. T. +2. There is a large bulged cystoid scar, to which the pupil is drawn. The lens is dislocated and is lying obliquely, one edge being tilted upwards and forwards; it is pushed right up into the bulged cicatrix. Microscopic examination shows that the iris has not been removed up to the periphery, and therefore relief of tension was not obtained, in spite of there being a large cystoid scar.

No. 20 (4611).—The lateral half of the eye of a female, aged 80, who had iridectomy for glaucoma performed seven years before excision. There have been many attacks of pain since that time; the eye has been more or less blind for 15 years. T. —. The cornea is flat, opaque, and vascular, and there is no anterior chamber, the iris being in contact with the cornea. The lens is opaque. The vitreous is detached, and forms an umbrella-shaped mass; there is some blood in the space beneath this. There is extensive retino-choroiditis.

No. 21 (3924).—Dissection of an eye which was removed on account of pain, after having been rendered blind by chronic glaucoma. The portion of the periphery of the iris which was in contact with the cornea is well seen. The pupil is slightly eccentric.

No. 22 (4960).—Section of a blind eye which was excised in a state of acute glaucoma. The anterior chamber is very shallow and the pupil semi-dilated; the angle is blocked by adhesion of the iris to the back of the cornea. The optic disc is deeply cupped. The retina and choroid are *in situ*.

No. 23 (5010).—The eye of a woman which had absolute glaucoma. There is no anterior chamber, the iris, lens, and cornea being in contact. There is a deep glaucoma cup, and the fundus is covered with hæmorrhages. The eye is myopic.

No. 24 (92 O.P.).—Section of the eye of a person who suffered from absolute glaucoma. The iris is much atrophied, and is adherent to the cornea. The lens is somewhat displaced and pushed up in close contact with the iris. The optic disc is deeply cupped. The retina and choroid are not obviously affected.

No. 25.—Dissection of the eye of a gentleman which was excised as being blind and painful. The iris is much atrophied, and at the periphery it is seen to be flattened where it was in contact with the cornea. A portion of the iris has been removed, so as to show the lens somewhat displaced.

SERIES III.—*Subseries (B)—continued.—Secondary
Glaucoma in Adults.*

No. 18 (4352).—Lateral half of the left eye of a female aged 60. The sight failed and the eye became painful three years previous to excision; it quieted, but again became painful. T. +. The cornea is opaque, and microscopically it more resembles ordinary fibrous tissue than cornea. The lens is lying in the anterior chamber; the iris, which is atrophied, is behind the lens. The retina is detached from the optic disc to the ora serrata.

No. 19 (4340).—Lateral half of the left eye of a female, aged 40. When first seen in January, 1894, this eye showed slight signs of glaucoma. Eserine was put in and this produced acute glaucoma at once. Iridectomy was done upwards, and then it was discovered that the lens was slightly dislocated outwards. Tension again became high, and iridectomy was done inwards in April, 1894. It remained quiet, but on June 6 the right eye became dim, and, shortly afterwards, iritis and keratitis punctata developed; this left eye was then excised. There is a scar at the upper and inner sclero-

corneal junction and a coloboma in this position. The lens is displaced somewhat outwards, pushed forwards and tilted so that the inner and upper part is lying almost in contact with the middle part of the cornea. Microscopic examination shows that the iris has torn, and that the root of it is left behind, and, therefore, the iridectomies were unsuccessful; the angle on both sides is closed by adhesion of the root of the iris to the cornea. The vitreous is shrunken, and it is slightly infiltrated with small, round cells. The retina is *in situ*. The ciliary body is inflamed, and the optic disc is cupped.

No. 20 (4583).—The lateral half of the eye of a man aged 34. The sight has been failing gradually for two years after a blow with a rivet. T. +. Eye frequently inflamed. An iridectomy has been done upwards, and the lens, which is opaque, is displaced and is lying close against the scar of the iridectomy wound. The retina is completely detached, and is lying as a cord stretched between the optic disc and the back of the lens; a cyst is seen in it. There is a blood clot lying in the subretinal space.

No. 21 (4216).—Lateral half of the eye of a woman, aged 31. She had a severe blow on the right eye three years before excision, and since then she has not seen well with it. It suddenly became painful eight weeks ago. There is a very deep anterior chamber, and this is almost entirely occupied with the displaced lens, on which there is some plastic exudation. On one side the iris is folded backwards, and on the other side it is lying stretched behind the lens. The angle of the anterior chamber is closed by adhesion of the iris to the cornea. The optic disc is deeply cupped.

No. 22 (4259).—The lateral half of the right eye of a man, aged 31. Twenty years ago the eye was injured by a blow from a tip-cat. It remained quiet until five days ago when he was kicked in it, since then it has been painful. The anterior chamber is shallow, and the angle is closed on both sides. The pupil is dilated and the iris is shrunken, with much ectropion of the uveal pigment. The lens is somewhat

displaced. On the anterior surface of the lens there is a projecting portion, having a circular outline, as though moulded by pressure against the pupillary margin of the iris. The retina is detached from the optic disc to the ora serrata, and contains numerous microscopic cysts. The choroidal vessels are well seen.

(Reported in Ophth. Soc. Trans., vol. xiv, p. 140.)

No. 23 (4208).—The lateral half of the eye of a man which was accidentally found to be blind seven years before excision. The iris is much shrunk, and the pupil is widely dilated. The anterior surface of the lens is moulded by pressure.

(Reported in Ophth. Soc. Trans., vol. xiv, p. 139.)

No. 24 (4811).—Vertical section of the eye of a woman aged 68, who had a cataract extracted 10 weeks before excision. The eye, after having done well, subsequently became inflamed, painful and glaucomatous. The cornea was hazy, and the anterior chamber deep. There is much lymph and lens matter in the pupil; the capsule is adherent to the scar and is dragged forward in the wound. The vitreous is degenerated and very fluid. The choroid and retina are *in situ*, and not obviously affected.

No. 25 (4838).—Section of the eye of a woman, aged 30, which became affected seven weeks before excision. T. +3. The angle of the anterior chamber is closed on both sides and the pupil is adherent to the lens capsule, probably by inflammatory exudation: the same material can be seen at the lower part of the chamber. The fundus is covered with hæmorrhages.

No. 26 (3853).—The eye of a man who was injured 60 years before excision with a stone. The globe is much enlarged. The iris, which is extremely atrophied, is adherent to the cornea at its periphery, and also to the old corneal wound forming an anterior synechia. The lens is absent. The vitreous is degenerated, and the whole fundus is a mass of retino choroiditis.

No. 27 (5141).—Section of the right eye of a woman, aged 39, which had gradually been failing for 20 years, but without pain. T. +1. The anterior chamber was entirely occupied by the lens, which has now fallen out, and the angle is closed. The vitreous is degenerated. The retina and choroid are thin and atrophied. The optic disc is deeply cupped.

No. 28 (4942).—Eye of a woman, aged 58, who suffered for many months from “inflammation” in it. The specimen is now much flattened on account of the impossibility of hardening it properly without losing the crystals. The retina is entirely detached, and the subretinal space contains much cholesterine.

SERIES III.—*Subseries C—(continued).—Glaucoma in Children.*

No. 11 (4508).—The lateral half of the eye of a girl, aged 6. When two weeks old she had an ulcer on the right eye. T. +. Antero-posterior diameter 26 mm. Transverse 24 mm. The eye is much distended, the coats are thin, and there is a considerable bulging in the ciliary region. The iris is atrophied and adherent to the back of the cornea, the ciliary processes being much stretched; the ciliary body is so thin that, even under the microscope, it can scarcely be seen. The lens is shrunken and calcareous. The retina and choroid are very atrophied, and the optic disc is deeply cupped.

No. 12 (4355).—The lateral half of the eye of a girl aged 17, who injured the left eye 11 years before with a fork while untying a boot-lace. The eye had been blind ever since. T. +2. Antero-posterior diameter 31 mm. Transverse 27 mm. Width of cornea 18.5 mm. Depth of anterior chamber in its middle 3.4 mm. The angle of the anterior chamber is closed by adhesion of the cornea to the iris for a distance of 3.5 mm. at the periphery. The iris is much thinned, the pupil is dilated, and there is some ectropion of the uveal pigment. The posterior chamber is very deep (4 mm.), and there is a tag of uveal pigment stretching across from the iris to the anterior capsule of the lens. The lens is repre-

sented by a circular mass of lens matter with a diaphragm across the centre like a circular water-cushion. This diaphragm is opaque and consists of the anterior and posterior lens capsules which are adherent. The suspensory ligament is thickened by inflammatory deposits on it, the vitreous is degenerated, and the retina is *in situ*. The pigment layer is almost entirely absent, and the choroid is atrophied. The optic disc is deeply cupped.

SERIES IV.

Subseries (B)—continued.

No. 8 (4720).—Portion of the eye of a man, aged 50, who had been suffering from rodent ulcer of the lid for some years. The eyeball became affected with a hypopyon ulcer, and was removed, together with the adjacent affected conjunctiva. A large mass of conjunctiva containing much inflammatory exudation and some new growth is seen overlapping the cornea. This is ulcerated, and some lymph is seen in the anterior chamber.

SERIES IV.—*Subseries (D)—continued.*

No. 15 (4782).—Portion of the eye of a woman, aged 32, the sight of which had been failing for six months. T. — 1.

The retina is entirely detached, and the subretinal space is partly occupied with a very deeply pigmented growth, which is springing from the ciliary body and the adjacent choroid. It has a broad base, and a constriction where it has apparently burst through the elastic lamina. The rest of the subretinal space is filled with dense coagulated albuminous material. The anterior chamber is very shallow, but the angle is open; there had never been any increase of tension.

No. 16 (4765).—Lateral half of the left eye of a woman, aged 60, who had noticed the sight failing for about five months. It had never been painful nor had she suffered from glaucomatous symptoms. T. normal.

The anterior part of the eye is healthy. Situated in the ciliary region and immediately behind the lens (which is in-

dented by it) is a large unpigmented sarcoma. It extends backwards to well behind the equator.

The retina is detached over the tumour and also to a slight extent behind it; the subchoroidal space is here filled with some coagulated material. The rest of the retina is *in situ*. The growth is composed of small round cells, with a slight tendency with some of them to become spindle-shaped. It is not very vascular, but a few vessels run through it. An isolated pigment cell is here and there seen in the section, but the growth is essentially unpigmented.

No. 17. (4779).—Lateral half of the left eye of a woman, aged 70, who has noticed the sight failing for two months.

The eye was blind and painful. T. + 3.

The anterior chamber is very shallow. The lens is displaced much to one side by means of a large and deeply pigmented growth, which extends from the iris to within 1.5 mm. from the optic nerve.

The retina covers the mass, and is elsewhere *in situ*, except at the posterior part of the growth, where it is slightly separated from the choroid by some jelly-like exudation. It is very vascular and deeply pigmented, and composed of round and a few spindle cells.

No. 18 (4748).—Antero-posterior section of the eye of a woman, aged 64, who had noticed the sight failing for three months.

T —. The cornea is clear and the anterior chamber shallow. Occupying rather more than a third of the globe is a very deeply pigmented melanotic growth. The retina is entirely detached over it, and it reaches from the iris in front to nearly as far as the optic nerve behind.

No. 19 (4561).—Lateral half of the eye of a woman, aged 61. The vision was normal, but it was found accidentally that there was a growth in the ciliary region. Microscopically it is seen to be a sarcoma, which is almost devoid of pigment in some parts, though at other places it is somewhat deeply pigmented.

The greater part of the growth is hollowed out into a

large cystic space which does not contain an endothelial lining. There are numerous smaller cystic spaces in the more solid part of the growth. The choroid is stretched over it, and the retina has been removed. The patches seen in choroid are post mortem.

(Reported in Ophth. Soc. Trans., vol. xv, 1895.)

No. 20 (4844).—Lateral half of the eye of a woman, aged 55, whose left eye had become misty about four months ago.

T. + 1. In the anterior chamber on one side is a slight bulging, and this corresponds to a small solid tumour which is situated in the ciliary body close behind the iris; it is about the size of a split pea; it is deeply pigmented. Microscopically it is seen to be a melanotic sarcoma.

No. 21 (139 O.P.).—Lateral half of an eye removed for sarcoma. There is a fairly large growth in the choroid, and the ciliary body is just affected. Before the eye was removed the tension was — 1. The angle of the anterior chamber is open.

No. 22 (4991).—Eye of a man, aged 61, who had noticed the sight failing for five weeks. T. — 1. The cornea is clear and the angle of the anterior chamber is open. Situated beneath the choroid, and extending from the ciliary body to somewhat beyond the equator, is a large mottled growth. Microscopically it is seen to be a sarcoma, having pigment scattered sparingly through its substance. The choroid elsewhere is *in situ*, but the retina is extensively detached by means of coagulated albuminous material which is beneath it.

No. 23 (5232).—Eye of a man aged 28. The sight began to fail about six months previously, and a detached retina was seen four months before excision. Four days before removal the eye became suddenly painful. T. + 2, with all the signs of acute glaucoma.

The angle of the anterior chamber was quite closed, and the cornea steamy. The retina is entirely detached, and the sub-retinal space was filled with blood. Growing from the choroid, and slightly encroaching on the ciliary region, is a deeply pig-

mented sarcoma. The detached retina is seen in the section lying on the growth.

No. 24 (164 O.P.).—The eye of a patient which was removed by Mr. W. Sinclair, of Ipswich. The anterior chamber is normal, and the angle is open. Growing from the choroid and extending from the ciliary body in front to within 7 mm. of the optic nerve behind, is a large mottled pigmented sarcoma. The retina is extensively detached by means of some coagulated albuminous material, which has now been removed. Tension normal.

No. 25 (4684).—Eye of a woman, aged 74, which had been defective for an indefinite time. It has lately been painful. The anterior chamber is extremely shallow and almost obliterated. Growing from the ciliary body, and involving the neighbouring iris and choroid, is a large and very black sarcoma. The lens is much displaced by the growth. Patient died 21 months after the excision from "inflammation of the kidneys."

No. 26 (192 O.P.).—Eye which had recently become painful and glaucomatous. The anterior chamber is obliterated. Tension + 2. There is a very large, slightly pigmented sarcoma reaching from the ciliary body nearly to the optic disc. The retina is completely detached.

No. 27 (5309).—Eye of a woman, aged 60, whose sight had been failing for about a year. She was admitted with acute glaucoma, and the eye was at once excised.

The angle of the anterior chamber is closed and the retina detached. There is a diffuse sarcoma at the back of the eye; a nodule of growth is seen outside the sclerotic, and this can be traced microscopically through the sclera.

Series IV.—Subseries (E)—continued.

No. 42 (4486).—Lateral half of the R. eye of a woman whose sight had been failing for three years from detachment of the retina. For three weeks before it was excised it had been very painful and glaucomatous. There is an extensive detachment of the retina. Occupying a large area at the back

of the globe and beneath the retina is a flattened melanotic growth; this has come through the sclerotic at the place where the posterior ciliary vessels penetrate. Outside the sclerotic the growth is about three times as large as the part within, but it is not so deeply pigmented. The subretinal space was filled with a quantity of coagulated jelly-like material. Microscopic examination shows the growth to be a melanotic sarcoma. Patient died five months later of secondary growths.

No. 43 (75 O.P.).—Lateral half of the eye of a man which was excised on account of pain following glaucoma with detachment of the retina.

Situated at the back of the eye and beneath the retina is a large growth surrounding the entrance of the optic nerve and a considerable area on both sides of this. The retina is entirely detached, and the subretinal space was filled with very hard gelatinous material; the patches seen on the choroid were caused by adhesions between these two. The growth is shown by microscopic examination to be a sarcoma containing numerous large vessels; it is almost entirely devoid of pigment.

No. 44 (59 O.P.).—Portion of an eye of a man, aged 40, the sight of which had failed during a few weeks before removal.

The retina is detached at all places except at the optic disc and ora serrata. There is a growth situated at the yellow spot region beneath the choroid. It is entirely unpigmented, and is composed of small round and spindle cells.

(Specimen presented by Mr. Rockcliffe.)

No. 45 (4481).—Lateral half of the eye of a man who had noticed the sight failing for about six months. The outside growth appeared 10 days before excision. The whole of the globe is entirely filled with a melanotic sarcoma, which has found its way through the sclerotic at the position where one of the venæ vorticosæ perforate it. The mass outside is nothing like so deeply pigmented as that within the globe.

(Reported in Ophth. Soc. Trans., vol. xv, 1895, by Hodges and Ridley.)

No. 46 (4515).—Section of the eye of a child, aged 3. A white spot had been noticed in the pupil for two years.

The whole globe is filled with a soft tumour, which varies somewhat in appearance in different parts.

The choroid is entirely detached, and the most actively growing part is attached to its outer side, between it and the sclerotic. The vitreous chamber is filled with new growth, but here it is to a certain extent degenerated and broken down. Pigment stretches from the choroid into the mass outside it. The optic nerve is extensively involved.

Microscopically the growth consists almost entirely of small round cells with hardly any ground substance.

Many of the cells are much degenerated, while others stain well. In the region of the choroid there is a good deal of pigment scattered through the growth. It has more the structure of a sarcoma than of the ordinary glioma.

The growth subsequently recurred and filled the whole orbit.

No. 47 (4442).—Section of the eye of a man, aged 43, whose sight has gradually failed. The front part of the eye is quite healthy. Lying at the back of the globe and adjoining the optic nerve is an unpigmented sarcoma. It is beneath the choroid, and the retina is somewhat extensively detached, though it was less detached than it is now. The sclerotic is very thin, and bulged, and is almost perforated by the growth.

The tumour is seen microscopically to be a small round-celled sarcoma.

No. 48 (4795).—The right eye of a man, aged 71, who has known it to be blind for at least a year. It has been extremely painful for the last six weeks. The sight was good previous to this.

T. + 3. Occupying nearly half of the interior of the globe, and projecting through an aperture in the sclerotic, is a large melanotic sarcoma. The middle part of the growth and that connected with the part outside the globe is much less pigmented than the rest. It is entirely covered by the retina, and is beneath and in the choroid. It reaches anteriorly to the lens and lies against one half of it; posteriorly it reaches to within 10 mm. of the optic nerve.

No. 49 (4851).—Half of the left eye of a woman aged 37. The sight of this eye has been failing for a year and a half. For two months the eye has been almost completely blind. The tension was normal.

The cornea is clear; the anterior chamber is normal and the angle open. At the posterior part of the eye, and reaching from a point about 2 mm. from the optic disc to almost as far forward as the equator, is a deeply pigmented growth which shows a constriction in its middle. The retina is extensively detached.

No. 50 (137 O.P.).—Portion of the eye of an adult which was excised for acute glaucoma. There is a mushroom-shaped melanotic sarcoma situated at the back part of the eye; the angle of the anterior chamber is closed, and the retina is detached. The lens was *in situ*.

No. 51 (5127).—Section of the left eye of a woman, aged 67, whose sight had been failing for 18 months, but much more rapidly for the last six months. T. + 1. The angle of the anterior chamber is closed. Filling about two-thirds of the globe is a darkly pigmented melanotic sarcoma. The retina is entirely detached, and part of it is seen stretching from the side of the lens to the tumour.

No. 52 (5231).—Eye of a man, aged 56, who had noticed the sight of the left eye failing for nine months. On ophthalmoscopic examination a large detachment of the retina was seen. The tension was —. On the diagnosis of a tumour being made the eye was excised. Externally the eye appeared healthy. The anterior chamber is of normal depth, and the angle is open. The lens is *in situ*. Growing from the choroid on one side is a mushroom-shaped melanotic sarcoma. The retina is detached over a much larger area than that occupied by the tumour. At no place did the tumour extend sufficiently far forwards to touch the ciliary processes. The unusual thing about this case was the tension, which was —, although the ciliary body was not involved.

(Reported in Trans. Ophth. Soc., 1898.)

No. 53 (5113).—Eye of a man, aged 57, who had noticed the sight of the right eye failing three months. The eye was quiet and tension normal. The anterior chamber is somewhat shallow, but the angle is open. The lens is *in situ*. Situated at the posterior part of the eyeball, and extending from the edge of the optic nerve behind to the equator in front, is a large oval-shaped melanotic sarcoma. Its section has a mottled appearance. The retina was much more extensively detached than now appears, owing to a quantity of coagulated albuminous material which was beneath it.

No. 54 (147 O.P.).—The eye of a lady, which was removed on account of the presence of a tumour. She had been operated upon two years ago for scirrhus of the breast. She died shortly after the eye was excised from recurrent growths in the abdomen. The cornea is clear, and the anterior chamber shallow. The lens is *in situ*. The retina is extensively detached. Situated at the posterior part of the eye is a flattened growth, which extends from about 3 mm. on one side of the optic nerve to the equator on the opposite side; it has a semi-opaque appearance, and is beneath the choroid, which can be seen running on its surface. The head of the optic nerve is involved. A quantity of coagulated albuminous material filled up the subretinal space. Microscopically the growth is seen to be a glandular carcinoma having a structure similar to that of a cancer of the breast, of which this is a metastatic growth.

(Published in Ophth. Hos. Report, vol. xiv, pt. 3.)

Series IV—Subseries (F)—continued.—Glioma.

No. 23 (4672).—The lateral half of the eye of a child, aged 1 year and 4 months. A white spot was first noticed in this eye four weeks before excision. It has increased much in size during the last week.

Tension +. Cornea clear. Anterior chamber normal. Pupil semi-dilated.

About four-fifths of the globe is filled with a large white solid growth. Numerous spots of degeneration are seen in it.

The retina is completely detached, though on one side it can

be seen passing into the growth. The subretinal space was filled with coagulated albuminous material.

Microscopic examination shows that the root of the iris is adherent to the cornea.

The mass is a glioma growing from the vitreous surface of the retina.

No. 24 (4827).—Section of the eye of a child, aged 6 months. A white spot had been noticed for several weeks, but it had grown considerably lately. Tension normal. The cornea is clear. The anterior chamber is of normal depth. The lens is clear. The retina is completely detached, and beneath it and growing from it is a large glioma.

No. 25 (96 O.P.).—Section of the eye of a child, aged $5\frac{1}{2}$, who was under the care of Mr. Rockliffe, of Hull. The history is imperfect. The pupil is widely dilated, and the iris is atrophied. The retina is entirely detached, but growing from its inner side is a dense solid tumour; it reaches through the sclerotic and forms a mass lying at the back of the globe and to one side of the optic nerve. The nerve and its sheath are much thickened and involved in the growth. The interior of the extraocular portion is more dense than the exterior, which is semi-transparent and gelatinous looking. The subretinal space is filled with exudation, and the choroid is much atrophied and slightly detached. Microscopically the tumour is seen to be a glioma.

No. 26 (4848).—Section of the left eye of a child, aged $2\frac{1}{2}$. For the last eight months a white mass has been seen in it. Two months before excision an abscess of the cornea developed.

The eye is considerably enlarged. The cornea is opaque and the middle part is destroyed. The globe is solid throughout, but it varies somewhat in consistence. The part which represents the vitreous chamber is a good deal shrunk, and contains a quantity of fairly dense, broken-down tissue of granular appearance. The rest of the globe is filled with a solid semi-translucent growth. The sclerotic is perforated, and the mass extends well back into the orbit; there is a thin

capsule round it. The optic nerve is seen on one side, surrounded by the new growth, and infiltrated. Microscopic examination shows it to be a glioma, with very few vessels in it. (A later report says that the child is dying of recurrence in the socket, and the disease is manifest in the other eye.)

No. 27 (77 O.P.).—Section of the eye of a child, aged 15 months, which was excised for glioma. The retina is detached and unrecognisable; the whole of the subretinal space is filled with a white neoplasm, which is a glioma.

No. 28 (5123).—Section of the eye of a child, aged 2, in whose eye a white appearance had been noticed about nine months. Tension +. The angle of anterior chamber is quite closed. The lens is *in situ*. Growing from the vitreous surface of the retina is a larger glioma. A process extends forwards exactly in the position of the hyaloid canal and terminates at the posterior surface of the lens forming a secondary growth in this situation. The optic nerve, which is cut short, is involved.

No. 29 (5083).—Section of the right eye of a child, aged 2, which was much inflamed and had hæmorrhage in the anterior chamber. There was much conjunctival irritation. On section, the lens is seen to be displaced backwards and to one side. The retina is unrecognisable, being entirely detached and involved in the tumour. The growth is a glioma, having numerous hard calcareous patches in it. It is very greatly degenerated, and the optic nerve is extensively involved.

No. 30.—Posterior half of an eye of a child, which was excised on account of the presence of a glioma. The growth has perforated the eye below, and has become extraorbital.

No. 31 (5299).—Eye of a child aged 12 weeks. A white spot was noticed in the left eye eight weeks before removal. Tension +2. The anterior chamber and its angle are almost obliterated. The globe is two-thirds filled with a large glioma; it has numerous areas of degeneration, and the remains of the retina can be seen running from the optic disc to the back of the lens. The choroid is much atrophied.

No. 32 (170 and 190 O.P.).—Two eyes from the same patient, a child, aged 2. The left was removed two months before the right. The left was known to be affected since birth, the right a few days before removal.

The left eye is almost full of growth, and this is breaking down. The growth in the right eye is more solid, and springs from the outer surface of the retina.

No. 33 (5319).—Eye of a child, aged 5, whose R. eye was excised when she was four months old.

Shortly after the L. was seen to be affected. The eye has gradually shrunk. As it was blind and painful it was removed. The lens is displaced and calcareous. The rest of the eye, which is much shrunken, is full of growth, which is seen microscopically to be a glioma. The ciliary body is greatly affected, and possibly to this is due the shrinking.

(Reported in Ophth. Hosp. Reports, vol. xiv, pt. 3, p. 463.)

SERIES V.

Congenital Malformations of the Eye.

Among the numerous congenital malformations to which the eye is subject, there are but few which can be shown as museum specimens, though examples of one or other variety are of frequent occurrence, and are by no mean uncommonly seen clinically.

This description will be almost entirely confined to those conditions which are illustrated by specimens in the museum.

Microphthalmos.

This condition varies greatly in extent, and no sharp line of demarcation can be drawn between an eye which is highly hypermetropic and one which can definitely be termed microphthalmic. In extreme degrees the eye may be so minute as to be entirely missed unless carefully looked for, and many of these are wrongly classed as cases of anophthalmos. Although some eyes which may

be termed microphthalmic show no further change than that of being greatly diminished in size, yet it is by no means uncommon to find some other congenital peculiarity such as failure in the closure of a cleft leading to the formation of a coloboma of the choroid, iris, or nerve sheath. In other rare cases, cysts may develop in connection with the malformed eye (O.H.R., xii, p. 289); these cysts may be very much larger than the rudimentary eye, which is sometimes no larger than a hemp seed. They are caused by a weak or deficient sclera which leads to the formation of a staphylomatous bulging at a certain spot (Nos. 9, 10, 11).

Buphthalmos.

This is also known under the term congenital hydrphthalmos or congenital glaucoma.

This is a somewhat rare condition, and the eye presents a peculiar condition; it is considerably enlarged in all directions. The cornea may attain a very large size, and all the coats of the eye are more or less thinned. The anterior chamber is, as a rule, deep, and the optic disc cupped (No. 8).

All these changes are due to increased tension occurring in the young and elastic tissues of infancy, and the cause of the tension is the same as that met with in the glaucoma of later life, viz., the closure of the angle of the anterior chamber, and consequently the aqueous collecting in a more or less closed chamber leads to its becoming deep instead of shallow.

Orbit.

The congenital abnormalities affecting the orbit are few. Dermoid tumours are occasionally found, but these are rare.

The orbits themselves may be undeveloped or so small that they will not hold the eye at all. The appearance produced is that of great proptosis.

Conjunctiva.

The most common form of congenital affection of the conjunctiva is a dermoid tumour. Those which are superficial nearly always occur at the corneoscleral margin and overlap both structures to a greater or less extent. The deeper ones are mentioned in connection with the orbit, as they do not strictly belong to the conjunctiva.

Fibrofatty growths of a congenital nature are sometimes seen beneath the conjunctiva, and may, if large, project between the eyelids.

Cornea.

There are numerous congenital peculiarities about the cornea. It is much diminished in size in cases of microphthalmos (No. 9). It is increased in size in cases of buphthalmos (No. 8). Occasionally congenital opacities are developed in it, and also a more or less wide arcus somewhat resembling an arcus senilis; this is termed by Wilde arcus juvenilis.

Conical cornea is held by some (Tweedy) to be the result of an imperfect development of the cornea which leads to a weakness and consequent bulging of its central part (Trans. Ophth. Soc., xii, p. 67).

Congenital dermoid tumours are generally met with at the corneoscleral junction, and these may encroach to a great extent upon the cornea. They are mentioned under the head of congenital tumours of the conjunctiva. They frequently have hair bulbs in them, and these often begin to grow about the age of puberty, thus leading to considerable conjunctival irritation. Other very rare forms of dermoid growths are bands of skin running from the cornea to some part of the lid. Dermoid growths exactly corresponding to a coloboma of the lid are sometimes found, and these cases are nearly always associated with some other congenital defect.

Iris.

The iris is very liable to congenital defects and peculiarities. Defects or alterations in the pigment and its arrangements produce striking and obvious results.

Pigment is normally present in the epithelium lining the posterior surface of the iris, and in most cases it is also scattered through the stroma. The extent to which this latter is developed modifies the appearance of the eye. If there is little or none present, a blue colour is produced, owing to the dark pigment at the posterior surface being seen through the vascular stroma. If it is more or less thickly scattered through it, the different shades of green, grey, and brown are produced. If again the pigment be altogether absent from the iris, it is always associated with absence of pigment in other parts, and the condition known as albinism is the result (Nos. 4 and 7).

When the pigment forms nodules at the pupillary edge or actually turns round the pupillary edge and forms a ring of pigment on the anterior surface of the iris, this is termed ectropion of the uveal pigment. It is more often seen as a pathological change in some cases of atrophy of the iris than as a congenital abnormality.

Persistent Pupillary Membrane,

The pupillary membrane which is formed from the anterior fibro-vascular sheath of the lens should, under normal conditions, disappear completely before birth. It sometimes happens that some remains of it are left behind as fibres which arise usually from the anterior surface of the iris and stretch across the pupil to the opposite side; sometimes they only project into the pupil without going right across, and occasionally a fibre may run from the iris to the back of the cornea (No. 3).

Iridecæmia or Aniridia.

Cases are occasionally seen in which no iris is visible clinically, even when the observer is aided by artificial light and the ophthalmoscope. These cases usually have a small ring of iris which cannot be seen until a section is made of the eye (No. 2). Owing to the close apposition of the rudimentary iris to the periphery of the cornea, such eyes may suffer from glaucoma.

Coloboma of the Iris.

A congenital coloboma of the iris is often associated with other congenital malformations both of the eye and of other parts. The usual position for it to occur is downwards with a slight inclination inwards. It may be so slight as to cause a notch only in the pupillary area, or it may extend down, or nearly down, to the root of the iris (No. 4). If unassociated with other defects, the sight may be unimpaired.

Colobomata of the choroid and optic nerve sheath are not illustrated by any specimens in the museum.

Persistent Hyaloid Artery.

The hyaloid artery, under normal circumstances, has quite disappeared before birth. In early foetal life it is continuous with the central artery of the retina, and runs forwards to the posterior fibro-vascular sheath of the lens, which structure it supplies.

It usually runs through as a single vessel, but it may divide into branches before reaching its destination. Occasionally it happens that the artery, or some portion of it, persists after birth, and can be seen with the ophthalmoscope; it may remain as a vessel containing blood or as a small fibrous degenerated process running forwards for a greater or less extent into the vitreous.

Its presence is sometimes associated with other con-

genital defects, and when persistent and patent it may run in a mass of fibrous tissue just behind the lens, which will probably be cataractous (Nos. 5 and 6).

DESCRIPTION OF SPECIMENS.

No. 1.—Series of six foetal eyes, ranging from the fourth to the ninth month.

No. 2.—Dissection of an eye of a child who died, aged 3, as the result of a burn.

There is congenital aniridia with anterior polar cataract. The cornea and sclerotic have been removed.

The ciliary body is seen to end in a rudimentary iris; this, however, was not made out to be present during life.

On the front of the lens there is an anterior polar opacity, caused by a subcapsular proliferation of the lining epithelium.

No. 3.—Dissection of an eye in which a small tag of pupillary runs across the pupil. It is so fine that it can hardly be seen without a lens.

No. 4.—Iris and adjacent parts of the eye of an albino rabbit, in which there is a congenital coloboma of the iris.

No. 5.—Portion of the eye of a child, aged 5 months, which was excised on account of its having the appearance of one in which a glioma was present. The lens was quite clear. It is now opaque. Behind the posterior capsule there is a dense white membrane (the posterior part of the fibrovascular sheath). Passing straight through the centre of the vitreous from the optic disc to the white membrane is a thin, thread-like band, which expands slightly when it arises from the disc; this is the persistent hyaloid artery.

(In cases similar to this, but with the lens opaque, the dense membrane behind it would not be visible. If now the lens were broken up by needling, the membrane would appear after absorption had taken place; this would be far too dense to needle, and if an attempt were made to withdraw it with capsule forceps, probably the greater part of the vitreous would come away with it.)

No. 6.—Dissection of an eye, showing a persistent hyaloid artery.

No. 7.—The posterior half of an albino rabbit's eye, showing opaque nerve fibres.

No. 8.—Eye of a child, aged 5, suffering from buphthalmos, which was excised on account of pain. T. + 2. The globe is enlarged in all directions, and the coats are very thin. The cornea measures 15.5 mm. in its longest diameter, and 14.5 in its shortest. The anterior chamber is very deep, and the lens, which was present and *in situ*, has been removed.

The vitreous was more fluid than natural.

The retina and choroid are greatly atrophied, but are not detached. The optic disc was deeply cupped, but is not seen in the mounted specimen. Microscopic examination showed that the angle of the anterior chamber was quite closed, through adhesion of the iris to the cornea at the periphery.

No. 9 (4984).—Microphthalmic eye from a man, aged 28, which had been shrunken since birth. It has recently been painful. The other eye is healthy. The eye measures 8 by 8 mm. In front was a small, clear cornea, of 3 mm. laterally, and behind the optic nerve was visible. Posteriorly was a cyst, measuring 17 by 8 mm. On section the cornea was normal in thickness, the anterior chamber shallow; iris and ciliary body present. The interior of the globe is almost entirely occupied by the lens, which measures 2 mm., and is calcareous. At the lower part behind the equator the sclerotic ends abruptly, and there is a gap reaching to the lower part of the optic nerve. To the point where the sclerotic is absent the cyst is attached; its outer wall is continuous with the sclerotic. Nearly all the retina is contained in the cyst.

(Reported in Trans. Ophth. Soc., vol. xvii, 1897.)

No. 10.—Eye of a child, aged 14 weeks, which was much shrunken. A cyst-like space, containing retina and solid contents, was present, as in the last case, and in addition a plate of cartilage covered the front of the eye.

(Reported in Trans. Ophth. Soc., vol. xvii, 1897.)

No. 11.—Eye of a girl, aged 12, which had been shrunken since birth. The eyeball is small, and there is a large cyst attached to it. The cornea is very thick, the cyst projects from the posterior part of the globe, and the sclerotic is continuous with this. There is a coloboma of the iris, and the lens is shrunken and calcareous; the cyst and vitreous are filled with folded membrane, and at the neck of the cyst there is some bone.

(Reported in Trans. Ophth. Soc., vol. xvii, 1897.)

SERIES VI.

Myopia and Hypermetropia.

Eyes illustrating the changes in myopia or hypermetropia are very seldom obtainable for museum preparations, unless they are affected by some disease which makes their removal necessary, consequently most of the specimens in this section exhibit other gross lesions.

Hypermetropia produces but little change in the eye, and this is entirely confined to the ciliary muscle, which is usually much hypertrophied. The antero-posterior diameter of the eye is shorter than in the emmetropic eye. It is also found that most eyes affected with primary glaucoma are hypermetropic.

In myopia the changes in the anterior part of the eye are very slight. The ciliary muscle is usually much smaller than in emmetropia. The chief pathological changes occur in the posterior segment, and they are primarily the result of an elongation and stretching of the posterior pole of the eye. This stretching is most seen on the temporal side of the disc. The result is that the sclerotic, and with it the choroid, get pulled towards this side. As, however, the entrance of the optic nerve into the eye is a comparatively fixed point, the traction chiefly affects the surrounding parts, so that we find the sclera and choroid thinned and atrophied on the temporal side, and the choroid drawn partly over the optic disc on the nasal side.

This stretched area constitutes a posterior staphyloma,

and the sclerotic here is often extremely thin (Nos. 1, 2, 4, and 8).

In addition to the thinning of the choroid and retina, inflammatory changes are likely to ensue, giving rise to patches of retino-choroiditis (No. 4).

As the result of the abnormal conditions to which the eye is subjected, various other changes make their appearance. The vitreous may become separated from the retina at the posterior part (No. 3); degenerative changes may take place in it, which render it more or less fluid and opaque, and finally the retina may become detached, and this will render the eye hopelessly blind (Nos. 4 and 6).

No. 1 (2165).—Section of the eye of a man, aged 25, who had a "cold" in it 10 years ago, but no injury. The eye is extremely myopic, its antero-posterior diameter being 38 mm., and its transverse 27 mm. The cornea and iris are adherent, and it has evidently undergone much inflammatory change. All the coats are greatly thinned, and the choroid is atrophied to a very marked degree, especially at its posterior part; here there is an enormous posterior staphyloma.

No. 2.—Section of an eye which shows numerous inflammatory changes in its anterior part. Its antero-posterior measurement is 31 mm.

No. 3 (3425).—Extremely myopic eye, with posterior staphyloma. The lens is now opaque, and the vitreous is degenerated. The retina and choroid are *in situ*, but there are numerous patches of retino-choroiditis; the coats of the eye are much thinned.

No. 4 (3696).—The eye was injured 56 years ago, and it had been defective since that time. It is extremely myopic, the antero-posterior diameter measuring 32.5 mm.

The anterior chamber is deep, and the iris is covered with lymph.

There is a very large posterior staphyloma. The choroid is greatly atrophied. The retina is entirely detached from the optic disc to the ora serrata.

No. 5 (5070).—Section of a myopic eye which was also affected with a perforated ulcer of the cornea. The iris is inflamed and atrophied. There are numerous patches of choroido-retinitis. There is a well-marked posterior staphyloma, with a ring of atrophy around it.

No. 6 (5292).—Myopic eye of a man which has been blind for 22 years; its antero-posterior diameter = 28·5 mm.

The lens is absent, the retina detached, and the O.D. is cupped.

No. 7 (5294).—Section of a degenerated myopic eye.

The anterior chamber is deep, and the lens was displaced into the vitreous, which is much shrunken. The retina and choroid are *in situ*.

SERIES VII.

Normal Series.

No. 1.—Normal eye of a man who suffered from a sarcoma of the orbit, which necessitated the removal of the globe. The retina is now somewhat puckered, as the result of hardening agents.

SUPPLEMENTARY CATALOGUE

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